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CENTRAL KURDISTAN.*

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The outline of the geographical features of Eastern Turkey is well known, and the highlands of Kurdistan and the plateau round the great Lake of Van have been described by many travellers.† I propose, therefore, to take a section of the mountain districts south of the lake, not so well explored, but interesting from its strikingly varied mountain scenery.

Kurdistan is but a geographical expression for the country inhabited principally by Kurds, and is spread over several administrative provinces of the Turkish empire, ranging along the Persian frontier up to the Trans-Caucasus and west to the borders of Asia Minor. The Kurds are essentially a race of mountaineers; they leave the Mesopotamian plain to the Arabs, and their country commences with the first outliers of the hills rising from the edge of the Tigris basin.

Central Kurdistan consists of the mountainous districts round the headwaters of the Bohtan and the Great Zab, two of the largest of the Tigris tributaries; the former is sometimes called the Eastern Tigris, and at its junction is little inferior in volume to the main stream, while the latter is the largest affluent that the Tigris receives throughout its course. The lake or inland sea of Van has itself no outlet, and is pent up along its southern shores by a series of lofty ranges extending from the Persian frontier many miles to the westward. South of these ranges the dreary outline of treeless brown hills, varied only by

* Read at the Royal Geographical Society, April 29, 1901. Map, p. 248.

† Lake Van is about 5260 feet above sea-level. It has a periodic rise and fall of about 8 feet, lasting five years each movement. Its water is bitter and undrinkable containing chiefly carbonate and sulphate of soda.

the rugged summit of some extinct volcano, which constitutes the scenery of the Van plateau, gives place to lofty mountain ranges and deep wooded valleys draining westward into the main stream of the Bohtan. Farther south a continuous range of high rounded hills divides this from the Great Zab basin, where the scenery becomes still grander, comprising lofty Alpine ranges, rocky gorges, and wooded cliffs.

The hills south of Lake Van are not a continuous range, but are divided up by various streams which rise north of the general line of the watershed, and then force their way back through the main ranges towards the Tigris instead of to the lake. The principal mass lies in the centre of the south shore, the Agherov Dagh, rising generally to 11,000 feet. It is snow-capped except for a few months in the year, and rises with but little margin from the shore, forming a fine background, enhancing the setting of the lake, and redeeming the dreariness of the northern shore. Over the eastern corner of the lake the range culminates in the Ardost peak, with steep rocky slopes overlooking the fertile valley of Vostan with its celebrated orchards and perennial streams.

East of Ardost the continuity of the range is sharply broken by the valley of the Shattakh stream and other tributaries of the Bohtan, rising among a mass of lower hills quite denuded of vegetation now, and with a surface mainly composed of sheets of rock. A curious isolated peak rising to 11,500 feet, the Bashit Dagh, then appears towering above the others, and having on its summit the tomb of a celebrated Kurdish sheikh, to which pilgrimages are annually made and sheep sacrificed. A low irregular line of hills connects Bashit with the watershed dividing from the Great Zab, and completes the circle round the headwaters of the Bohtan, which are formed by the many streams of the upland basin of Nurduz converging to one point a little north of Merwanen, below which they enter a succession of deep gorges.

The range dividing the Bohtan from the Zab presents a continuous line of great rounded hills for a considerable distance, beginning at the Persian frontier. These summits with their many springs and streams, taken together with the Nurduz basin, form an unrivalled pasture-ground for the numerous flocks of the neighbouring Kurds, nomad or sedentary. The long winter is very severe, and although some villages exist in Nurduz and a little cultivation is carried on, its chief wealth is in its pasturages, which can only be occupied in June, when the snow is melting and the young grass has come up. The Chukh pass on the Van-Bashkala road crosses at 9500 feet, and some of the summits west of it rise to 12,100 feet, while a more prominent peak south of Merwanen, the Kokobulend, to probably 13,500 feet. There is no general name for the whole range, but each rounded summit or minor peak has some local name given it by the tribe who pasture their flocks near by; usually

such names have a pastoral origin, as Av-i-Berkhan, "the water for lambs;" Givri Chevrosk, "the hare's ear;" Dola Beranan, "the little goat's leap;" and so on.

A remarkable feature are the "yailas," or small upland plains shut in among the higher summits, often giving 3 or 4 miles of level grassy pasture, watered by springs and streams of icy-cold water, which disappear into deeper valleys in the lower slopes. The Tuzek and Nebinov yailas are near Merwanen, and a little to the south-west is the specially remarkable "yaila" of Farashin, "the joyful pleasant place," the largest of all, in which are the headwaters of the Khabur, a tributary of the Tigris. From about the middle of June to the end of September these

KURDISH TENT ON A "YAILA" IN NURDUZ.

yailas and pasturages are occupied by the various tribes, each having its area carefully delimited, which it occupies year after year, often after much discussion and possible bloodshed. Roughly speaking, it appears that the strongest man with the most sheep generally manages to appropriate the best pasturage. The scene in early June as the tribes begin to arrive is one of much animation and beauty. Great drifts of snow still lie about, and almost before they have completely melted, a perfect carpet of varied flowers comes springing out of the ground: among others the alpine gentian, various kinds of tulip, ranunculus, iris, and such old friends as the English primrose and cowslip are to be seen. These, with the vivid green of the young grass, the brilliant sunshine,

and bustling animation of pitching the tents and camp life generally, make a brilliant scene typical of Kurdish life.

Practically, the whole of the tribes occupying Nurduz and Farashin are comprised in the great group of Hartoshi Kurds, divided into twelve subsections, most of whom live in villages in the winter. But there is an important nomad portion under Hajji Beg, the most powerful chief, who occupy Farashin in the summer, and migrate to the Tigris plains near Zakho in the winter; these are true nomads, always living in their tents.

At the higher elevations on the Van plateau, the tribes find the distance too great to migrate to the Tigris valley, and spend the winter in villages. These are generally a collection of half-underground mud hovels, which are really looked on as a temporary resting-place until the season becomes more favourable, and tent-life, the true life of the nomad, can be resumed. The Kurd is seen at his best in tents, tending his flocks and engaging in a pastoral life, always ready to dispense hospitality with an open hand and welcome the stranger with a bowl of "airan," the thick curdled milk mixed with water which forms their staple drink. Many of the villages on the Van plateau and in Nurduz are completely deserted in summer for tents; the few household effects are readily removed, the door is left swung open, and the house takes care of itself. A few men may be found left to tend any patches of cultivation and gardens close by, but otherwise not a soul is to be seen.

The wide basin enclosing the pasture-lands of Nurduz has a gateway to the westward, with a lofty range on either hand like pillars guarding the narrow opening. A spur from the Agherov Dagh runs south until over the river gorge near Shattakh, and there terminates in the rocky mass of Arnost mountain; this, with a long flat-topped ridge known as the Maidan Tash, both rising to about 11,000 feet above sea-level, with very abrupt rocky slopes, overhangs the little town and villages of Shattakh. The other pillar, across the valley, is formed by a long spur of the Zab range jutting out south of Merwanen and terminating in the Gilolokan mountain, which towers over Shattakh from the south, and is also quite 11,000 feet above sea-level. Shattakh itself, by the river-bank, is but 4900 feet, so that the huge dimensions of this gap, 5000 feet deep and 9½ miles across, can be realized.

Owing to their confined situation at the foot of such steep slopes, the numerous small villages clustering round Shattakh as a centre suffer a good deal from destructive avalanches, which have been known to bury an entire village. About the centre of the Nurduz basin the river makes a sharp bend to the north-east, entering a series of deep rocky gorges with slopes well wooded with oaks, and here and there small villages with terraced cultivation on some favourable part of the

hillside. In this gorge, also, is the celebrated Armenian monastery of Hokotzvank, which contains the tomb of Tiridates. Shattakh village is at the junction of a fine stream, coming down a wooded valley from the north, which affords easy access to the Van plain. Like many of these streams, this has its origin in a huge spring which gushes out of the rock and is known as the Kani-spi, or white spring. The Bohtan itself and this stream swarm with fine trout, which are usually caught at night by a couple of men, one holding a torch to attract the fish, and the other wading about with a barbed spear ready to impale the fish when he sees them.

Around Shattakh the valleys first become wooded, junipers being

PASS LEADING DOWN INTO SHATTAKH.

found first on the slopes from 6500 to 7500 feet elevation, below which all the lower levels are thickly covered with oaks, which may be called the national tree of Kurdistan. In the districts within easy reach of the Van plateau trees have been ruthlessly exterminated for firewood, in many cases dug up roots and all; while throughout the country trees are stunted from the prevalent custom of cutting the small branches with their leaves in autumn and storing them as winter fodder for sheep and cattle. In the valleys the most striking tree is the walnut, which gives a welcome green effect to the predominating tints of grey rock or brown hills. Sycamore and ash are found by the streams. On all the upland pastures of the country the slopes are

covered with low shrubs of gum tragacanth, or "gavvan," growing about 18 inches high, which burn very readily if a light be applied, and are generally used for kindling. The gum is never extracted in this part of the country, but is so in South-West Persia. Wild rhubarb plant exists in considerable quantities on these hills also, and is brought into Van for sale in the early summer.

Grey bears and the wild pig, especially the latter, are to be found in fair numbers in the Shattakh valleys, and do much damage to the crops at night. The lynx is also found in the deeper and wilder gorges, but is very rare. On the open uplands round Nurduz the wild sheep and moufflon are found in considerable numbers, and the ibex, or wild goat, on the crags and cliffs. The stone marten and tree marten are to be found, and are much sought after for their skins; also a grey squirrel is very common in these Bohtan forests. In addition to the red-legged and grey partridge, which are found in extraordinary numbers on these slopes, is the giant partridge, or "Ur Keklik," which is rather larger than a blackcock, and is generally in pairs or single, found at elevations not less than 8500 or 9000 feet.

The Shattakh gorge continues for some miles below the village, and affords some strikingly grand cliff scenery, the left bank especially showing sheer masses of rock forming spurs of Gilolokan; while on the right, high up the slope, watered by plentiful springs, is the large Armenian village of Gachit and some others, each with a rich patch of garden and orchards, with wheat and millet on small terraces on the steep slope. The gorge opens near the small village of Khumara; but only on the left bank do the hills recede and the country become more open, while on the far bank rises a huge wall of grey limestone for quite 2000 feet, supporting the southern slopes of the Arnost mountain. The rough summits of the Agherov range and Arnost afford in places grazing for the flocks of numerous sections of the Miran nomad Kurds.

A little above Khumara, on the left bank, the Yezdinan stream joins from the upland pastures of Kavalis district, similar to Nurduz, but smaller, and on the other slope of the Gilolokan range; the lower course of this stream is through a remarkable gorge bordered by huge walls of rock, and sheltering a few villages of Alan Kurds, a section of the Hartoshi. On a splendid crag which overhangs the junction of the streams are to be found the traces of an old castle known as the Kelli-Ziril, said to be of great antiquity, and from the peculiar rock scarping, like that of Van citadel, was probably an outpost guarding the approach to the lake plateau in the Chaldean times when Van was a capital city.

Below Khumara the river valley is strikingly beautiful, having on one side even wooded slopes and occasional rocky ravines, with a few villages of Hawishtan Kurds among the trees, in the centre the

foaming torrent of the Bohtan tumbling over boulders, and on the other side the steep buttresses of Arnost, with a few Armenian villages, each in a dark green patch of gardens and cultivation, halfway up the nearly inaccessible slope. A few miles further down on the left bank, a large tributary called the Masiro, or "river of fishes," joins from the high uplands forming the watershed with the Great Zab. A wide gap occurs here in the ranges following the left bank of the Bohtan, and on its far side abruptly rises the stony flat-topped mass of Harakol

IBRAHIM BEY, CHIEF OF TAKURI KURDS.

Dagh, terminating in an enormous crag at its south-eastern corner. Curiously enough, the Masiro does not come through this gap, but instead has carved for itself a very deep gorge through the main ridge, cutting a fragment from it in the shape of a remarkable flat-topped mountain called Awrakh, whose summit is ringed round with cliffs, and only accessible by a rugged path on the south. The end of the range from which this has been severed is a great wall of cliffs, with oaks and junipers clinging wherever they can get foothold. This

gorge is known as the Tang-i-Balian, and affords some splendid cliff scenery. On the many pasture lands round here are to be found in summer the tents of the various sections of the Miran tribe of nomads under Mustapha Pasha, who has great wealth of flocks, and goes for the winter to the Tigris plain about Jezire. In point of numbers, they come next after the Hartoshi among the large nomad tribes of this part of the country.

In recent years both these tribes, at least the nomad portion, have discarded the distinctive Kurdish dress of a short jacket of thick goats' hair, a black and red turban, with gay waistcoats and flowing sleeves, and have taken to the Arab headdress, with handkerchief kept in place by looped strands of camel-hair, and flowing robes like the Bedouin. This is by no means an improvement, and when I saw Hajji Beg, the Hartoshi chief, in his tents in Nurduz, he was attired in a black Stambuli frock coat.

Beyond the gap dominated by Harakol, separated only by a low col, a wide basin opens, draining south-east by the various tributaries of the Hazil river, which spread out fanlike between narrow shale spurs covered with oak forest and converging towards the mouth of some fine gorges, through which the stream passes to join the Khabur near Zakho. This curious district is entirely uninhabited, except when the nomads pass through in their migrations, and a few Kurds gathering oak-galls. The Bohtan now enters another deep pathless gorge, the Ghelli-Herin, and then the hills trend back, and the valley becomes more open, although the river keeps in a deep ravine sunk below the general level of the open country. This is the district of Bohtan, or Bohtan Berwari, and is among the most fertile and productive parts of Kurdistan. This zone is sufficiently elevated to escape the great heat of the middle Tigris basin, is watered by countless springs and streams, and is yet sufficiently warm to produce rice, cotton, figs, and pomegranates, and a great variety of fruits. The extreme severity of the winter on the upland plateau is here avoided, and the half-underground hovels of that region give place here to a better style of house, usually two-storied, with wooden verandah. The Kurds are here divided into a number of small sections, each under its own bey, and are not nomad.

A large northern tributary joins from the district of Mukus, which is separated from Lake Van by the main Agherov range, and shut in on either hand by lofty spurs from it. The Mukus stream has its origin above the village in the Bash Bulak, a splendid spring of clear cold water (mentioned by Layard), which has a great volume in the early summer, but becomes much reduced in the autumn. The local idea that it is an outlet of Lake Van is obviously wrong, as the barometer shows it at a much higher level. Mukus, or Meuks (Armenian), is a compact district with many Kurd and Christian villages in seven smaller valleys

radiating from the main one, and was the ancient Roman province of Moxene, which name is still preserved in its present title.

One of the hills overlooking Bohtan Berwari from the south bears the Kurdish name of Nuh-i-Giran, or descent of Noah, and a tradition points to it as the resting-place of the Ark, the fertile valley of the Bohtan at its base being the first country entered. It may be as well to note, in connection with this, that not far to the south, overlooking Jezire on the Tigris, is the Jebel Judi, or Jew's mountain, to which Mohammedan tradition points as being the veritable resting-place of the Ark also. There are no historical remains in these districts in the shape of cuneiform inscriptions, and the Kelli Ziril, near Khumara, mentioned above, is

VILLAGE OF MUKUS.

the only probable remnant of the Vannic period. But in Nurduz are numerous examples of the remains of some historic race which occupied that country, in the shape of stone forts built of immense rocks roughly shaped and joined without mortar, which must have taken considerable skill and labour to place in position, and must be more than the work of mere shepherds. Most of them in Nurduz are now nearly level with the ground, but I was fortunate in obtaining a photograph of one near Elk, in the Khabur valley, which has seven tiers of great blocks, and the building is roughly 12 yards square, with no trace of door or windows now to be found. These forts were placed commanding all the principal passes into the upland pastures, and some were on the

"yailas" themselves. Their use was apparently to defend the pastures and flocks against raiding-parties of some foes, as doubtless these uplands have for many ages been used for little else than a summer grazing-ground. The only modern Kurdish idea I could determine was that the forts were built by a race of giants, who handled these stones like pebbles, and were finally brought into subjection by Solomon the Great. There are also in the tea-room a few flint, or rather obsidian, implements and fragments of pottery of a very ancient date, prior even to the Chaldean times, found in a tumulus near Van by the expedition of Dr. Belck and Lehmann in 1898.

Passing to the other side of the main watershed, into the upper basin of the Great Zab, the scenery becomes much bolder and more striking; the high rounded summits, with their "yailas," give place to splendid rocky pinnacles, and the Zab valley is a deep gorge of striking grandeur, joined by others scarcely less beautiful from the ranges on either hand. What is perhaps most striking is the extraordinary depth of the river gorge between the lofty summits on either side, and in a day's journey the actual horizontal distance is only a few miles after almost as much climbing of perpendicular slopes or stair-like paths.

The Zab rises in an uneventful way among the low hills along the Persian frontier, close to the point where the Chukh Dagh merges in the frontier hills; its earlier course is down the broad valley of Albak among open meadows, passing the small town and seat of government at Bashkala, at the foot of the hills to the north. A few miles below this the valley quickly narrows, and the first of a long series of tortuous gorges is entered, from which the river never manages to escape even for a brief moment, until but a comparatively short distance before its junction with the Tigris; it is always a mountain torrent pent up between rocky walls, with little room even for rough bridle-paths along its banks. South of Bashkala, along the frontier ranges, the country is fairly open, and contains the curious plain of Gavar, 25 miles long and 5 broad, which lies close under the Jelu ranges to the east, and from its formation appears to have been once a lake. The southern end is now a reedy lake, fed by some fine springs, and the whole plain usually becomes flooded on the melting of the snows and during the autumn rains. The centre of the plain is occupied by several Nestorian villages, which cultivate the fertile soil, and round the edges are many Kurdish villages of the Doshki, Heriki, Biliji, and Deri section of the Hartoshi, whose interests are chiefly pastoral. The plain level is 6500 feet above the sea, with an extremely severe winter climate, and is drained by the Nihail stream, a tributary of the Zab, which it joins soon after it enters the main gorges. To the south, just below the junction of this stream, with scarcely any transition stage in the shape of minor outliers, rises the great mass of the Jelu mountains, with a summit line of splendid crags and pinnacles,

which show up even bolder and loftier when contrasted with the rounded contours of the hills to the north, and by the isolation of the general mass towering far above the frontier hills.

The hills to the north above Nurduz and Bashkala are very deceptive as regards their height, as they are without prominent peaks that catch the eye, and it was rather a surprise when the boiling-point thermometer gave the height of the Tozo summit above Bashkala as 12,100, while some rocky crags of the Welitan mountain near by were 1000 feet higher, or 13,100. The main gorge of the Zab is too narrow and precipitous to contain many villages, and consequently the inhabited districts are in the several valleys joining the main stream in succession

KOCHANNES, RESIDENCE OF MAR SHIMUN, THE NESTORIAN PATRIARCH.

at right angles. At first most of these are on the right bank of the main stream, the first below Bashkala being the Kurdish valley of Shivelan, draining the Harifta mountain, which rises to about 11,500 or 12,000 feet, and is a southern offshoot from the main watershed. The valleys now become much deeper and narrower, with precipitous sides, on which a few oaks may be found; and draining the west slopes of Harifta is the Berwari valley, with six villages of Nestorian Christians. Below this is the valley of Kochannes, draining the wide upland pasturage of Berchilan, over which towers the rocky cluster of peaks forming the summit of Kokobulend,* the culminating point of all the

* This peak seems undoubtedly the same as that called Karnessa-ou-Daoleh by

watershed range. The village of Kochannes is interesting as the residence of Mar Shimun, the patriarch of the Nestorian Christians.

A few miles lower, and separated by a broad col, in which are the two prominent rocky peaks of Chaila and Berichaila, comes the valley of Julamerk, with broad easy slopes at its upper end, with many streams irrigating ricefields and finding a narrow rocky exit at its lower end into the rift of the Zab valley. Julamerk was formerly the residence of the Mir or chieftain of Hakkiari, which is the general name for all these mountain districts bordering the Zab. The place is now the centre of Turkish government, and the few remains of an old castle on a prominent crag overlooking the village are all that reminds one of the old Kurdish rulers.

Nearly opposite the mouth of the Kochannes valley is that of Des on the left bank, to be described later, and opposite Julamerk the rocky gorges of Uri, Erik, and Kiyu, too precipitous to afford room for any habitations except a small village in the last named. Leaving Julamerk, the Zab makes a wide bend to the west, and passing over a broad col in some southern outliers of Kokobulend, the small Kurdish valley of Selai is entered, which drains through a deep rift into the main stream, but whose upper basin has some pretty villages among walnut trees and terraces of cultivation. Across the deep river-gorge is the mouth of the large valley of Tal, with several Christian villages, up which a track leads to Amadia, shorter than that following the western bend of the river. Bending somewhat to the north the wide upland basin of Lewin is entered, with several minor valleys, and supplying the largest tributary of the Zab on this bank. The hill formation remains the same throughout in these valleys, the upper basin of rolling hills sometimes steep, of shale formations with little rock showing, and with a countless number of springs and streams. Nearer the Zab, overhanging the river itself, hard rocky formations abruptly supervene, and the scenery quickly changes to wild crags and gorges, giving a far more striking effect. The upper part of Lewin is thus a very pleasant upland, with many Kurd and Christian villages with orchards and gardens. Lower down the stream enters a fine gorge leading into the main stream.

Below Lewin, on the right bank, are the valleys of Upper and Lower Tiari, and on the left bank the long valley of Salebekkan and Tkhuma, which complete all the districts of the Nestorian Christians. At the head of Lewin valley the main watershed becomes parted in a curious way in the centre by the Farashin upland, in which the Khabur, a large tributary of the Tigris, rises. This stream, formed by many springs and rills in Farashin, soon enters a deep narrow gorge, well

Layard. The name Koko Bulend is given by the people on its southern slope, the Kurdish nomads on the other side probably having other names for it (Layard's 'Nineveh and Babylon' (1853), p. 422).

wooded, with some splendid crag scenery on its border slopes. The valley is first occupied by the villages of the Gavdan and Mamkhoran Kurds, and further down, round Elk and Beit-es-Shebab, by the Zshiriki. The most remarkable feature in these ranges is an immense wall of rock which commences in the Awrakh Dagh overlooking the Bohtan valley, continues south-east, bordering the basin of Hazil, and finally crossing over into the Khabur valley near Elk. It is known as the Dahazir ridge, and although at first there are broken places where the rock has fallen away and passages lead through, yet on the crest overlooking Elk, it is a perfectly unbroken wall several hundred feet high, facing out to

GROUP OF NESTORIAN CHRISTIANS.

the south-west, with a summit line nearly straight. The Khabur forces its way through this line, but on the far bank the ridge, still a straight wall of grey rock, soon attains the same elevation, and continues over into a tributary valley of Lewin, where it ends rather abruptly, although traces of the same formation exist, connecting up across the Zab with Jelu mountains. The crest line between the Khabur and the Zab attains to an elevation of about 10,500 feet, and only a single pathway leads across it by what is called the Deria-i-Zir, or Golden Gate, a name given also to the whole ridge, not from the existence of any precious metal, but from the fact that in former times a powerful chief held up any parties of nomads or caravans passing through, and made them pay a golden toll.

Turning now to the left bank of the Zab, there is first the Jelu Dagh, overlooking Gavar plain and the Zab valley. The general name given by the Turks to the whole range is the Jelu Dagh, but the various peaks and crags have local names, which require care to identify, as Kurd and Christian have each their own names, and it was only after making a complete circuit of the range and asking many guides that the final names could be determined. At the eastern end of the main range is Galianu, a long ridge of friable rock and shale of very steep contour, but possible of ascent after a difficult climb. The boiling-point thermometer gave the summit as 12,115 feet, and the view was superb to the south-west over rugged crags and gorges, in which the middle course of the Zab could be traced, and beyond, just visible in the haze, the commencement of the Mesopotamian plain.

To the south across a deep wide chasm was the rocky line, streaked with snow, of the summits of the Sat Dagh, which rise slightly higher than Jelu itself; and eastward the Gavar and Bashkala plains with the frontier hills were spread out to view. There is a small isolated peak at the extreme end of the ridge, on the summit of which was said to be a cuneiform inscription; but the rock is very friable, and if there ever was one there, it has now become worn away. At the extreme summit of the pinnacle, reached by some steep steps and holes cut in the rock, are the remains of a building, partly cut out of the rock and only a few feet square, which might have been a hermit's cell, but most probably was a watch-tower to give alarm of possible enemies from Gavar. The Nestorians claim it as the summer residence of Balak, their national hero of pre-Mohammedan days, who is said to have stabled his horses either on the rocky pinnacle or on the steep slope beside, which is a manifest impossibility. A rocky col severs Galianu from the main group, the central figure of which is the sharp peak of Geliashin, or the Blue cliff in Kurdish, which may be also identified as the Tura Shina of Layard, Shina in Syriac meaning "a cliff," and the name "the mountain of the cliff." Another Syriac name is Tura Khwara, or the White mountain. On all sides, except a narrow ridge on the south-east, are sheer precipices of several hundred feet, and after three attempts, in each of which I was brought up against lines of huge cliffs, I finally discovered that a steep path to the summit existed on the south-east side, but it was too late then to attempt it. The only guides procurable were very misleading, making any statement, if they thought it would please, and were very difficult to verify. The summit ridges swarm with ibex and moufflon, and many of the giant partridge were also seen. Judging from Galianu, the summit of Geliashin must be at least 1500 feet higher, or 13,500 feet above sea-level.

From Geliashin a razor-edged ridge of limestone rock runs nearly due west for a few miles, and terminates in a very sharp-pointed peak known as the Suppa Durek, or Lady's Finger (mentioned by Layard),

a prominent landmark in the confused outline of crag and pinnacle west of Geliashin. A col which gives access by a stair-like path from the Zab valley into Jelu district now intervenes to the west, beyond which runs a rugged watershed range of lesser elevation, but containing the sharp peak of Khisara, quite inaccessible except by the wild goats, and enclosing the rocky gorges of Kiyu and Uri draining to the Zab, and overlooking Jelu and Baz to the south.

A little south of the main ridge of Geliashin, and forming part of the group, are two masses of rock, one the Tura Dauil (David's mountain), and facing it across a deep chasm-like valley, the other called Nakhira Shirka, both rising to about 11,000 feet. The north slopes of

MAIN JELU RANGE FROM THE N.W., SHOWING GELIASHIN PEAK IN THE CENTRE, AND SUPPA DUREK ON THE RIGHT.

Geliashin and Suppa Durek are perhaps the grandest, as the ground falls away in a splendid succession of crags and precipices into the head of the valley of Des or Deezan, and the stream-level of the Great Zab, only 12 miles off, but 9270 feet lower.

Below the crest a small glacier nestles under Geliashin on the north, giving rise to the Des stream, called in Turkish the Kar Su, or Snow water, and in Syriac, Mia Khwara, or White water. Des is the first, on the left bank of the Zab, of the Nestorian Christian valleys, each of which comprises a little community or canton by itself under its own malik, the spiritual head being the Patriarch Mar Shimun, who lives at Kochannes, in a similar valley on the far bank of the Zab nearly

opposite Des. The valley of Des, especially in its upper part, affords the most picturesque and varied crag scenery imaginable, and of its seven villages some are not visible from the track by the stream, but are perched on some favourable terrace of ground to obtain more room than the narrow chasm affords, and escape the summer heat and malaria below. A village so situated has its "chumbi" or suburb in the valley itself, consisting of a few houses and mills, with walnut trees and scanty patches of cultivation in the bends of the little stream.

The valley is not without its historical interest, as at the junction with the Zab are the ruins of a fine castle called the Mudebbir Kale, after a celebrated Mira of Hakkiari of some fifty years ago, while higher up is the Suringa Kale, a prominent crag, the scene of a protracted struggle between the inhabitants of Des and the forces of Bedar Khan Beg, a Kurdish chief of about the same period.

Quite at the head of the valley, on a rocky cliff, is the tiny church of Mar Giwergis, or Saint George, in which a service is only held once a year, on the saint's name day. On the north-eastern slopes of Geliashin are some smaller glaciers, giving rise to streams going down to Gavar; and under Galianu on that side is a large circular pool or moraine formed by ice-action.

On the south, in the cleft under Tura Dauil, is a large mass of snow, over which a precipitous path from Jelu to Gavar leads, and this is all the permanent snow remaining at the end of summer; but, seen from Gavar at the end of June, the Jelu mountains were a fine sight, with all the crags and precipices jewelled with ice-crystals, masses of snow, and huge icicles.

The south side of Jelu is drained by the Rudbar-i-Shin, a large mountain torrent which forces its way through difficult gorges in a wooded country between limestone ridges, to join the Zab below Amadia, and whose course is not unlike the Zab, in that it is joined by several lateral valleys on either hand, each forming a separate canton of its own.

Just south of the main range is the Christian district of Greater Jelu, draining down into a northern arm of the Rudbar-i-Shin, and whose principal centre is Marta Mar Zaia, or the village of a Saint Zaia. The fine crag of Tura Dauil overhangs the village, and is a limestone wall of striking appearance, distant barely 2 miles, but the summit 4500 feet above, with quite 1000 feet sheer precipice. A little only of the Geliashin ridge is visible, but sufficient to show near the top of the cliff a rectangular opening, the mouth of a cave, lighted by a curious shaft in its rocky roof, and called by these imaginative people the cradle of Mar Zaia. In the village is a fine church, in which hang some lacquered jars, votive offerings brought by Nestorian missionaries returning from China, where they ministered and made converts before the Mohammedan era; while close by are later offerings of

American clocks and other articles, presented on a safe return from a long European tour.

The inhabitants of Jelu, in distinction to those of the other valleys of Tiari and Tkhuma, are wonderful travellers, making begging tours to all parts of the world. Consequently, people talking a little English are easy to find, but it was rather disconcerting to be addressed in a strong American accent by a man who had been through the recent Spanish war as an American sailor, but who had just returned to tend

VALLEY OF DES, SHOWING SURINGA KALE.

his home farm, the sense of attachment to this little canton in a valley under Geliashin being stronger than the delights of civilization. One old fellow, who had finished his travelling days, said he knew London well, but the only name he could just then remember was Bow Street. Another was returning with a comrade from a successful tour in the Brazils, when his friend died off Lisbon, leaving £175, which was handed over to the Turkish consul at Lisbon until proof of next-of-kin relationship was established. The man was starting for Lisbon this

spring. This gives a good idea of the extraordinary way in which these people exploit the whole world in their tours.

Farther down the valley from Jelu is the district of Baz, with a group of villages surrounded by orchards and little terraces growing maize and millet, which form the principal food, wheat having to be imported from Gavar. These are an industrious people, quite different from the jovial beggars of Mar Zaia, and are famous for their skill in carpentering and working iron, to carry on which they go to Mosul and other large towns.

West of Baz is the little basin of Tovi, containing a Kurd village of that name; and beyond rises a fine mountain, the Ghara Dagh, or Ghara de Bazin, with precipitous sides, but open rounded summit, used as summer pastures, or "zoma," by the people of Baz, and also those of the Christian districts of Tkhuma and Salebekkan, draining down to the Zab on the far side of the mountain. South of the Jelu ranges, but separated from them by a wide deep gap, is the Sat Dagh, or Ser-i-Sati in Kurdish, not quite so striking in its lonely grandeur as Geliashin, but rising somewhat higher to about 14,000 or 14,500 feet, as far as I could estimate from Galianu, the summit being a line of rugged pinnacles and crags, rather higher at its western end. On the upper part of its northern slope could be traced some level pasture grounds, used by the Heriki Kurds, with abundant patches of snow between the crags late in autumn. To the north-west are thrown out some spurs of bare rock, which terminate over the valley of the Rudbar-i-Shin and the Kurd village of Oramar in some stupendous cliffs, which are just masses of greyish white rock without any relieving touches in their whole extent except the black shadows of the gorge of the Rudbar-i-Shin and its tributaries. A little oasis in this grey desert is formed by the orchards and gardens of Oramar, perched on a fertile terrace overlooking the gorge below, the centre of a Kurdish tribe of the same name, and famous for its grapes, which are a large white variety of oval shape, and fully equal to their reputation. Figs and pomegranates are also grown, and testify to the mildness of the climate. The Heriki are a large tribe with seven sections, some purely nomad, and others sedentary.

The nomads occupy part of the Persian frontier hills and the Sat Dagh in summer, and go down to the Mosul plain for the winter, crossing the Zab near Zebar. The chiefs usually have tents, but many other members of the tribe make booths of oak boughs at each halting-place, all the country down to the edge of the plain being well wooded with oaks and affording the necessary shelter. Their whole worldly goods consists of their horse, some sheep and goats, a few cooking-pots, and the inevitable Martini and belt of cartridges. The sedentary portion live in villages in three deep, almost inaccessible gorges on the south side of Sat Dagh, the general name of the district being also

Heriki. A branch of the Rudbar-i-Shin rises on the north side of Sati, and winds round through the gorges separating it from Jelu, and in the lower part of which is the Christian district of Ishtazin, and higher up on more rounded slopes the Kurdish district of Bashtazin. Some idea of the bold contour of the country and the depth of the Ishtazin gorge may be gathered from the fact that Galianu towers nearly 9000 feet above the stream-level at the lower end of the gorge, and is but 6 miles distant from it. The path leading from Jelu to Ishtazin enters the main gorge through a rift barely 8 feet wide, with perpendicular walls of rock. The Ishtazin villages, with their orchards and gardens, are situated on some spurs less rocky than further downstream, and

VALLEY BELOW SHEMSDINAN, TYPICAL OF COUNTRY THERE.

provide a welcome note of green contrasting with grey rocks towering on either hand. Below Oramar on the left bank a large stream joins from the western side of the Sat Dagh, up whose valley are the large villages of Sati and Deh, partly Kurd and partly Nestorian, the whole of this side of Sat Dagh overlooking the valley being a huge wall of rock nearly 6 miles long.

The Rudbar-i-Shin finally joins the Zab through a remarkable chasm called the Tang-i-Balinda, 3 miles long, through which not even a foot-track can be followed, although it is possible to scramble along the steep slope overlooking it. It here receives a large tributary from the north, rising in the Tkhuma hills, and called the Yahudi Chai, or

Jew's river, in which are the secluded mountain districts of Nervi and Reikan. As the name implies, besides the Kurds are many Jews among the inhabitants, probably a section of the fairly numerous Jewish population who live in villages round Akra and Begil to the south beyond the Zab. They have been here for centuries, and appear to be refugees from the ancient Nineveh (the modern Mosul), and, if their history could be traced, would be found quite as interesting as that of the Nestorians themselves. Many of them trade as small pedlars among the Kurds, and wander all about the mountain districts from Bashkala to Amadia and down to Mosul.

The Sat Dagh is an isolated mass separated from the Persian frontier hills by the lower end of the plain of Gavar and the upland valley of Khumara, and from the other ranges to the south by the deep valley of the Shemsdinan river, a tributary of the Zab formed by streams from Khumara and the Zerzan districts on the frontier. The whole district is known as Shemsdinan, with the centre of Turkish government at Neri, a large village prettily situated in a side valley off the main gorge ensconced amid walnut groves and orchards. The district is devoted to the cultivation of tobacco, which finds a ready sale in Persia, being of the variety suitable for smoking in the *kalian*, or Persian pipe. The trade is entirely in the hands of the influential Kurdish Sheik Sadik, who lives in Neri itself.

The scenery in this rocky gorge is quite in keeping with the districts just described, with the steep slopes of Sat Dagh, thickly wooded with oaks, and seamed by three rocky valleys, in which are hid the villages of the Heriki Kurds. On the south side rise the dark rocky masses of the Bash-i-Rua range, culminating in a fine peak known as Guraimiz Gavdan, the whole summit being a mass of black rocky crags and pinnacles, and the slopes almost inaccessible.

Such is a description of a portion of Central Kurdistan, fascinating in the grandeur of its wild gorges, grey cliffs, and oak-clad slopes, the home of the Kurds, the direct descendants of the Karduchii, who hurled rocks on Xenophon's troops as they forced a passage through their gorges, and whose wild secluded valleys form backwaters in which have come to rest remnants of Nestorians and Jews thrown aside by the various tides of conquest that have rolled over these historic lands.

Notes on the Geology by Mr. F. Oswald, who travelled in the Country round Lake Van with Mr. Lynch in 1898.

Unfortunately, very little is known about the geology of Central Kurdistan. Ainsworth, in the *Journal* of this Society in 1841, gave a geological section along the Zab valley from Amadia to Bashkala, and both he and Loftus described the section from Jezireh to Bitlis. Since that date hardly anything has been done to increase our geological knowledge of the region; the following general conclusions are based on these sections, on some notes of a journey between Van and Sert, on my own observations in 1898, in the Gözelderah, on the south coast of Lake Van,

and on the descriptions by Loftus and Rodler of the geology of the Zagros, the south-easterly continuation of the Taurus ranges.

Broadly speaking, Central Kurdistan may be divided into four geological zones. The northernmost zone consists of marble, mica-schists, and clay-slates, of Palæozoic, or possibly Triassic age; they occur along the south coast of Lake Van, and form the axis and watershed of the Taurus. To the south of these ancient rocks there follows a great series of grey limestones and shales of Cretaceous age, frequently containing ores of lead, iron, and copper; still further south lies a belt of massive white Tertiary limestones, partly Eocene, with Nummulites, but mainly Lower Miocene, with occasional seams of lignite, *e.g.* near Sheranis and Herbol, north of Zakho; these limestones compose the broad undulating country of the lower Bohtan river. Finally, these rocks are overlaid by Upper Miocene red sandstones, with gypsum and rock-salt, which occur near Sert and Hazo, and especially form the foothills of the Taurus and Zagros, sinking into the broad plains of Mesopotamia.

Major Clayton, in 1887, recognized the dolomitic character of the Jelu mountains; it is not improbable that these strata are of a Triassic age. Ainsworth found abundant "madreporites" in the corresponding beds on the right bank of the Zab, but unfortunately did not identify these fossils. No Jurassic rocks have been found either in the Taurus or in the Zagros, although they are well known in Azerbaijan and the eastern border ranges of Russian Armenia.

There are many instances of a varied nature of igneous or plutonic rocks in this part of the Taurus, such as the tuff-crater of Sheikh Ora, breached by the waters of Lake Van; the basalt flows in the valley of Guzel Dere and the Bitlis Chai; the zones of serpentine; the intrusions of porphyrite in the Shirvan district, where there are ancient disused gold-mines; and, finally, the granite masses of Selai and Berichaila, near Julamerk.

In this highly-mountainous country, subject to earth-movements from a very distant geological period, many great faults have occurred, but none greater than the one which marks the southern limits of the depression of Lake Van and the Plain of Mush. It is even a greater line of dislocation than the great fault separating the Grampians from the central Lowlands of Scotland. There could hardly be a more striking contrast between the high rugged peaks of ancient marbles and schists south of Lake Van, and the broad Armenian plateau to the north, consisting of Cretaceous and Tertiary strata, flooded by lavas and dominated by great volcanoes.

Before the reading of the paper, the PRESIDENT said: The paper to be read this evening by Major Maunsell is on a very interesting part of Asia, and one of which we have had no account for at least the last forty years, and many parts of which are still unknown, and that is the central part of Kurdistan and the valley of the Tigris.

After the reading of the paper, the following discussion took place:—

Earl PERCY: I have been asked to make a few remarks upon this paper to-night, but I do not know that I can contribute anything of real value, because I do not think the haphazard impressions of an ordinary traveller are worth comparing to the scientific observations of a trained explorer like Major Maunsell. But, at any rate, I think I may congratulate him on behalf of the members of this Society for the very interesting and exhaustive paper which he has read, and on the magnificent photographs with which he has illustrated the lecture. He has described, I think, almost all the main districts of the Nestorian country, as well as the upper waters of the Bohtan river and the Great Zab. I do not know much about the

upper waters of the Bohtan river, because my first meeting with Major Maunsell was later on, when I was going into the Kochannes country; but there are several points upon which I think we should like some information, if Major Maunsell would give it. He has hazarded one or two historical and archæological comments, which I think are open to doubt. For instance, he has alluded to the stone implements found in the neighbourhood of Van; but I do not know of any trustworthy argument that can be deduced from the fact of stone implements being found in that neighbourhood, because we know they were used by populations living close to a very high state of civilization. I remember, for instance, in one of the deserts in Lower Egypt, coming upon a large mound of flint instruments, which are supposed to date from a very late period, when the dwellers on the banks of the Nile were in a high state of civilization. He has also alluded to the Jews, and said they were probably refugees from the city of Nineveh. I do not know that one can make any very confident assertion on that point, but I think it is open to question whether they were not the original settlers who were transferred after the fall of Samaria. Certainly there is a very distinct statement, I think, if I remember rightly, in the Second Book of Chronicles, to the effect that many of the ancient dwellers of Samaria were transferred to the "cities of the Medes" beyond the Tigris. There is one other point upon which I should like information, but I do not know whether any traveller in that district has gone into the question—that is, the geology. Of course a great deal of that country is composed of igneous rocks, such, for instance, as the range between the valley of Tâl and the valley of Tkhuma. I do not know whether I am right in supposing that the "Jelu" peaks are of dolomite formation. I remember a book which may be familiar to many of the members of this Society by Mr. Binder, who travelled in the country in 1886, in which he describes a visit he made to the country. I think he is talking of the mountain range which goes by the name of "Chella" and "Berechella," and he asserts that on that range he found a considerable tract of apparently fossilized forest. I do not know whether Major Maunsell, in the course of his travels, ever came across any traces of that kind; certainly I never did, but it would be very interesting to discover how far that had been done. I think Major Maunsell's map will be of very great value, because I know myself, from having been twice in this neighbourhood, the extreme difficulty that I experienced in getting any map of the least value at all. The whole of the northern part of the map has been very carefully and elaborately done, and my only difficulty in looking at it for the first time was that so many of the names used by the Nestorian population are quite different from the names given on the map. There is one part of the country upon which Major Maunsell has not said anything, because I think he, personally, has not travelled there. He has taken us as far down as the village of Oramar. Quite close to that village there is one of the finest peaks in the whole country; but it would be excessively interesting to know what is the nature of the country below that, between Oramar and Rezan, that is part of the tract which the Oramar Kurds take in the course of their annual migrations. My own belief is that the country south of Oramar consists of a very low rolling plateau; certainly the Rudbar-i-shin itself flows at a very much lower elevation than the surrounding country. The Diza plain is at a level of about 6500 feet, and the village of Ishtazin lies about 1000 feet lower, that is about 5500 feet, and at Oramar the level of the stream is only 3300 feet, therefore there is a very rapid drop, and that explains to a great extent the extremely narrow and deep gorges which make travelling in that part of the country so difficult. I do not know that I have any other observations to make, and I can only congratulate Major

Maunsell on my own behalf, and I hope on behalf of the Society, for the most interesting and instructive paper he has read.

Major MAUNSELL: I should like to answer a few queries put by Earl Percy. As regards the petrified forest on the pass between Kochannes and Julamerk, I passed over that route, and could find no trace of it whatever; I do not think any could possibly exist. The country is mostly of shale formation, and, as far as I know anything of geolo gy, I do not think such a thing would exist there. As regards the country between Oramar and Rezan, the formation is of flat-topped limestone ridges, with streams in deep narrow rifts, and much lower than the Sat-Dagh. The central ridge seems to be plentifully wooded on both sides, and towards the Rudbar-i-Shin has some fairly open, easy spurs on which are about a dozen villages, whose inhabitants come into Gavar in the summer, and later on go to the top of the Sat-Dagh. The Rudbar-i-shin leaves this country by a rude gorge which is almost impassable. As regards the general geology, I am afraid I can only speak as an amateur, but the country around Lake Van is remarkable for its various igneous formations. All round the Lake of Van are extinct volcanoes. On the western side is the great crater of Nimrod, which is 5 miles in diameter, but now extinct. On the north is the crater of Sipan Dagh, 13,700 feet; and away to the north-east towards Ararat is another large volcano, the Tendurek Dagh, which is still said to smoke slightly. But directly you reach the south shore of Lake Van an entirely different formation supervenes; there are no volcanic masses of any size until you get to the peak of Guraimiz Gavdan, which seems of an igneous formation, as well as the whole of the extremely rugged range which contains it. Most of that which contains the various "yailas" is shaly formation, and gives rise to easy-rolling slopes, which are suddenly broken by the great rocky wall of Deria-i-Zir and the Jelu mountains. As regards the settlement of the Jews, I went chiefly by the local tradition related to me in Mosul, and also in Akra, that they came from Mosul, the ancient city of Nineveh; but I do not know at what period they were brought from Palestine. The stone implements were dug up by the German expedition of Dr. Belck and Dr. Lehmann, who seemed to think that they were of a far more ancient date than what is called the Vannic Chaldean period.

The PRESIDENT: It only remains for us to thank Major Maunsell for his interesting paper. We have had accounts of this region before, and I can remember the paper that was read by Mr. Taylor, although it is more than forty years ago, and the very interesting discussion which followed, in which Sir Henry Rawlinson told us a great deal about the history of the country. Major Maunsell has shown us and described to us the beauty of the scenery, but I think this is enhanced by the extraordinary historical interest connected with the region between Lake Van and the valley of the Tigris. I remember Sir Henry Rawlinson expressing his opinion that this region is the Ararat where the ark rested, and not the peak in Armenia, the honours of which are only derived from a much more modern tradition. The country is also extremely interesting from the march of Xenophon through it after he left the valley of the Tigris. I believe a part of the country was also possessed by the Crusaders, and there are points connected with it of the deepest interest, such as the history of the marches that were made across it in the times of the Eastern Emperors; and, to go back to much earlier times, there are the remnants of the old religions of the East which remain in these valleys. The religion of the Yazidis is connected with the ancient bird which occurs so frequently in remote Persian history. It was called the *Malik Taus*, and was supposed to have been a peacock made either of bronze or of silver; but nobody knows the real history of that religion. All these historical points immensely enhance the interest connected with this magnificent scenery; but it is late now, and we have only time

to pass a very cordial vote of thanks to Major Maunsell for having given us such an excellent idea of the magnificent mountains of this part of Kurdistan. I am sure you will pass this vote of thanks unanimously. And I think we ought also to thank Earl Percy for his friendly criticism of this paper, through which a great deal of additional information, especially respecting the geology and archæology of the country, was brought out in Major Maunsell's reply.

NORTHERN BOLIVIA AND PRESIDENT PANDO'S NEW MAP.*

By Colonel GEORGE EARL CHURCH.

THE Royal Geographical Society is indebted to his Excellency Colonel José M. Pando, President of Bolivia, for a new and interesting map of the north-eastern part of that country, transmitted to us through his Excellency Señor F. Avelino Aramayo, the Bolivian minister to the court of St. James.† It includes the extensive explorations made personally by Colonel Pando between the years 1892 and 1898, and throws much-needed light upon an attractive section of South America, which, from the days of the Incas, has seemed to challenge exploration. It lies to the east of the cradle of the Inca empire, from which no man can look across Lake Titicaca at the magnificent range of white-bonneted peaks which marks the line of the inland Andes without an almost irresistible inclination to break through one of its gaps and plunge down the slope into the Amazon valley, to solve the mysteries which lie hidden there. The Inca Rocca, the successor of Manco Capac, entrusted to his son, Yaguarguaque, an expedition of 15,000 men to conquer this region, then called Antisuyu. He easily penetrated from Cuzco to Paucartambo, and thence, with great difficulties, to Tono—the first coca plantations of the Indians, but went no farther. Even the great Inca Yupanqui could not resist the temptation; and, according to Garcilaso de la Vega, sent a numerous, well-equipped army which reached the Tono river, spent two years in building rafts, descended the river Mayu-tata, or Amaru-mayu, and conquered the countries to the east of Cuzco as far as the plains of Musu, now known as Mojos.‡ It is probable that this expedition did not reach the falls of the Madeira, but on arriving at the level country, at about 12° S. lat., struck to the south-east and crossed the Beni river into the Mojos territory, keeping a short distance from the base of the foothills of the Andes in the more or less open lands.

* Map, p. 248.

† The geographical world will learn with pleasure that, continuing his services to science, President Pando concluded a contract, on February 15, 1901, for the survey of that part of the Andean plateau belonging to the Department of Oruro and La Paz, between Lake Titicaca, the Desaguadero, Pampa Aullagas, and towards the east to the summits of the inland range of the Andes.

‡ In the *Proceedings of the Royal Geographical Society* for June, 1883, will be found a most interesting paper on "The Basins of the Amaru-mayu and the Beni," by Sir Clements R. Markham.

Soon after the conquest of Peru by the Spaniards, the Inca domination of the region subdued by Yupanqui ceased, and the savage tribes at the eastern base of the Andes resumed their independence, which they have tenaciously guarded up to the last twenty years. The rule of the Incas was forgotten among them, except on the Tono river, where traces of Inca settlements can still be found.

Only a short period of time elapsed from the date of the Spanish conquest before an expedition of note attempted to reach the Mayutata. The conclusion of the civil war between the Pizarros and Almagros in Southern Peru (in 1538) left Hernando Pizarro surrounded by many dangerous and turbulent followers of whom he desired to rid himself. He therefore gave permission to Pedro de Candia to lead a body of three hundred men, across the Eastern Andes, from Cuzco into the Amazon valley. Herrera says that Candia entered by the slope which is limited on the north by the river Opotari and south by the valley of Cochabamba, which is called the Mojos road; and that, finally, he took the route across the Tono Andes, and, in Opotari, 3 leagues from Tono, found a large town, 30 leagues from Cuzco. Although terrorized at the difficulties which they encountered at every step, the men forced their way further onward, through a rough country covered with dense forests of ever-increasing thickness; but, after four days, they were opposed by savage hordes, who told them that they "had nothing but small houses covered with branches of trees, that their arms were bows and arrows, that they ate roots and yuca, which they cultivated, and with that they lived contented; and that in those forests there were monkeys and pumas and some tapirs, which they killed with arrows, and advised them not to go further on, because they were getting lost." After penetrating a little more to the east under almost incredible hardships, the expedition returned to the mountains.

Hernando Pizarro then deprived Candia of his command, and allowed one of his most esteemed companions, Pedro Anzurez de Camporedondo, to organize a force to conquer the province of Mojos by the way of Caravaya, the Inca name of which was Collahuaya. He gathered a large and enthusiastic body of adventurers, supported by several thousand Quichua Indians, and started, in 1539, from the town of Ayabire. He descended the mountains to Sandia and San Juan del Oro, centres for the working of the rich gold-washings of Caravaya, which had been exploited in Inca times, but by which pass is unknown—probably by one about 100 miles south of the river Tono. He then entered the present Bolivian province of Caupolican, called Zama, which is the Ixiamas or Ysiama of to-day, in the north of the same province. Ixiamas, Tumapasa, Aten, and Cavinas form a large district, west of the middle Beni river, occupied by the Tacana Indians. The expedition seems to have crossed this great river, which they

called the Amapalcas, and to have penetrated far to the south-east into the territory of Mojos. It probably reached the vicinity of the Mamoré river a little south of the present town of Trinidad. Then, sending out a small scouting party, a great river was discovered running from east to west, doubtless the Grande branch of the Mamoré. After five months of terrible hardships, the expedition returned to the town of Ayabire, having lost 4000 Indians and negroes and 143 Spaniards The former suffered from hunger to such an extent that as fast as their companions died the survivors ate them.

In 1576, the rival Spanish expeditions of Tordoya and Maldonado, numbering several hundred adventurers, penetrated to the headwaters of the Mayu-tata. Here they so fiercely fought against each other, for three days, in the dark, dense forests, that nearly all were killed. The few survivors were beset by the savages, who killed Tordoya and captured Maldonado. Other expeditions of minor importance followed during the Spanish colonial period, but accomplished nothing. In 1835, General Miller descended from Cuzco to the forests of Paucartambo; but, during the first half of the past century, the War of Independence and the general exhaustion which followed left the tribes on the eastern slope of the Andes to bury in oblivion the memories of Spanish inroads upon their forest strongholds.

In 1851, Lieut. Gibbon, of the U.S. Navy, reached the Tono and Mayu-tata from the Andean tableland, and as he gazed upon the riotous wealth of nature which surrounded him, and reflected upon the direction taken by the great river at his feet, he wrote, "All the silver and gold of Peru are not to be compared with the undeveloped commercial resources of this beautiful garden." There he found the brave and good Padre Bovo de Revello, an Italian Carmelite monk, with his little flock of neophytes. He had changed the name of the river "Amarumayu" of the Incas to "Madre de Dios," for the reason that the savages, after having killed a number of his people and destroyed their church, had thrown the image they worshipped into the water, which had floated down-stream, and was afterwards found on a rock in the middle of the Mayu-tata. It seems destined to retain the name conferred upon it by the pious father, although it is known to the Tacana Indians along its banks as the Mayu-tata, or Great Father river.

Markham followed Gibbon, and in 1853 descended from Cuzco, and obtained a view of the Mayu-tata, believing, like Gibbon, that it was the upper Purus.

On December 26, 1860, the gallant Peruvian, Colonel Faustino Maldonado, with a most scantily equipped expedition, and only twelve men, essayed the task of descending the Mayu-tata throughout its course. He reached the Tono, at its confluence with the Piñi-piñi, where he embarked on a rudely constructed raft, passed the mouth of the Inambari on January 8, and, fighting his way through savage

tribes, entered the Beni, and, soon after, the Madeira, at the falls. Here he met a friendly tribe of Caripunas, who advised him, as they also advised me in 1872, to always keep to the right bank in descending that formidable line of cataracts. On March 18, six of the party, in a bark canoe, had the unfortunate idea to take the west side of the river at the Caldeirão do Inferno (Cauldron of Hell). Four of them were lost, including Maldonado. This cataract has a length of about 1½ mile. For the first quarter of a mile it falls over 7 feet, and for the remainder of the distance 13 feet. The volume of water it carries is immense, the river being about a mile wide. In descending, it is the custom to hug the right bank at the commencement, but I got caught in a violent current in mid-river and could not gain the shore. My canoe, with her twelve Indian paddlers, was not 5 inches out of water. The great stream seemed to hollow in the middle, as if the bottom were dropping down. A reef, extending from an island, crossed it diagonally, showing a high and angry wall of foam. Towards this barrier, the current drove us with frightful velocity. My Indians were dismayed, and were on the point of jumping overboard, as is their custom in such dangers, when I seized a Colt's army revolver and swore I would shoot the first one who disobeyed an order. The little craft danced almost upon the edge of the reef, when it was suddenly caught by an eddy, thrown to the right, and whirled round the flank of the reef into open water, between it and the shore. All this was tame in comparison to what now met my eye. To quote from my journal, "We shot currents, rapids, whirlpools, waves, and foam as lightning zigzags through a cloud. We went down the main cataract at the rate of 20 miles an hour. I stood in front of our little rush cabin, waving my revolver to the right or left as I desired to indicate the direction the captain should steer. In mid-river, along the lower reach of the rapids, was a ridge of water perhaps 40 feet wide in its widest place. On its rounded edge, sharp, spiteful waves of foam were playing. On each side there was a return of the river forming a gigantic whirlpool, and, as we shot along the crest, the return waters sped up-stream with dizzy velocity. Twice the side of the canoe nearly touched them—twice grazed death; but my muscular Indians and their cool, splendid captain, Pedro Ycho, took us safely through." This is the fall where Maldonado lost his life, after solving the problem of centuries as to the course of the Mayu-tata. A few years later, the exploration of the Purus, by Chandless, demonstrated, mathematically, that this river had no connection with the streams so many travellers had seen at the foot of the Andes, east of Cuzco.

In 1865, Antonio Raimondi descended the Paucartambo river a short distance below the town of that name, and then crossed the inland range, eastwards, towards the sources of the Mayu-tata by the Cusilluyoc pass. By a steep descent, he reached the plains on the following day, "populated towards the close of the past century by numerous flourishing

estates of cacao and coca, a region which, later, was the theatre of sanguinary struggles with the savage Huachipairis and Tuyeneris, who destroyed, in a few days, the work of many years." He then examined the upper rivers which unite to form the Mayu-tata, and returned to Paucartambo.

Colonel La Torre, Prefect of Cuzco, pronounced "the Madre de Dios the broad, open tomb for explorers." It received him also, in his expedition of 1873. He reached a point near the main river, and died pierced by thirty-four Indian arrows.

Besides the numerous efforts made to explore and occupy the region of the Mayu-tata by descending the Andes to the east of Cuzco, numerous expeditions, during and after the Spanish colonial period, attempted to reach the lower Beni and Mayu-tata districts by way of the Beni river from La Paz, and from Sandia, on the Caravaya slope of the Andes. The Franciscan convent at La Paz was especially zealous in its efforts to establish missions in the district in question, and clung tenaciously, but not always successfully, to any foothold it gained. Cavinas, on the middle Beni, appears to have been its main outpost.

In 1560, Diego Aleman, a resident, and one of the founders, of La Paz, organized a company to discover the territory watered by the Mayu-tata. He descended the mountains to the north of Cochabamba, but, on the border of Mojos, was routed and made prisoner by the Indians. Then followed the Licenciados Balboa and Garcés, who reached the Mayu-tata, but returned on account of insufficient resources. The information gained caused Padre Miguel de Urrea to penetrate the region. After remaining for a considerable period of time, he was killed by the Sabainas. Then followed the Curate Calacoto, who was forced to return without results.

Padre Rafael Sains, in his "Memoria historica del Colegio de San José de la Paz" (unpublished),* says that Pedro de Aleguí Urquiza obtained from the king a privilege to conquer Caupolican. With a strong expedition, he founded his first town, San Juan de Sahagun de Mojos. He then founded Apolobamba, and pressed on to Aquachile, an Indian town, where he died of fever. His disheartened followers then abandoned the two last-named places and retired to Mojos. Urquiza was governor of the famous gold district of Tipuani, and discovered the ancient military road which the Incas opened by Suri and Camata. "It passes near Atén by the height of Altuncama, near Apolobamba, and runs northward; then goes through the gorge of Siliamas and continues to San José de Chupiamonos. At the high points of the *pampa*, it has small fortifications. Its width is very regular, and the road is paved according to its locality. It presents well-founded proof

* See 'Limites de la provincia de Caupolican ó Apolobamba,' por Carlos Bravo La Paz, 1890.

that, before the Inca Yupanqui entered Mojos, the inhabitants of Laricasa, Humasuyu, and Pacasa had communication with the peoples or tribes situated on the other side (the north) of the Amaru-mayu."

Padre Gregorio Bolivar, in 1620, and afterwards in 1631, pushed northward from La Paz into the lower Beni and Mayu-tata, but was never heard of afterwards. In 1629, the Jesuit father Bernado Rheus, from the Andes of La Paz, penetrated to the north of Apolobamba and perished by the hands of the savages. The Dominican monk Tomás de Chaves wandered for fourteen years to the north of Cochabamba in Mojos and the Beni. He returned to the convent of La Paz, and died about 1656. Friar Domingo Alvarez de Toledo took up the work, and, by the way of Caravaya, went 40 leagues northward into the territory of the Toromona savages in the Mayu-tata basin.

Padre Rafael Sains states that Gabriel Gonzales undertook the conquest of Paititi in 1670. He descended the river Beni, but his expedition was fruitless, and he returned. Several missionaries from Caravaya, whose names he gives, reached the lands of the Araonas in 1680, where they remained two years, and retired disconsolate at the ill success of their mission. Seven more then went from Sandia, and under most disheartening difficulties, founded ten *reductions*, or Indian settlements, in two years, some of which were afterwards abandoned. From this time forward, the persistent missionary fathers, especially those of the convent of La Paz, generally held to the ground they had gained, but never found it possible to effect a permanent lodgment in the basin of the Mayu-tata. It is probable that, in the eighteenth and nineteenth centuries, they possessed much more information than the geographical world in general regarding northern and north-western Bolivia, and that the convents of Cuzco, Moquegua, Juli on Lake Titicaca, and La Paz still contain much unpublished data describing the country, the course of the rivers, and manners and customs of the Indian tribes.

In 1879, my friend Antonio Raimondi published, for the first time, a letter which P. José Figueira, who in 1803 was curate at Cavinas, wrote to the superior of his college at Moquequa, describing a voyage which he made down the Beni from Cavinas. It seems that he reached a point near the confluence of the Beni with the Mamoré and "very close to the mouth of the rio Magno," or Mayu-tata, "which receives all the water of the mountains of Cuzco." The information given to him by an Indian chief, Yusayri, left no doubt that the Mayu-tata was the main affluent of the Beni.

The intrepid Padre Mancini, who resided from 1850 to 1864 in Mocetenes and northern Caupolican, directed his steps westward from his mission station, and, alone, with cross in hand, travelled over an immense area of unknown country, visiting many Indian tribes, such as the Guacanaguas, Machuis, and Toromonas. He then turned northward,

remained for a time with the Araonas, crossed the Mayu-tata, and entered the country of the Pacahuaras, lying between that river and the Purús. He made a rude map of his peregrinations, which I afterwards saw at the Recoleta Convent at La Paz, to which he belonged.

In 1866, two Franciscan friars, from the same convent, reached the Mayu-tata, five days' journey north-west from their mission at Cavinas. In 1869, in La Paz, I often met one of these good men, Padre Fidel Codinach, a native of Spain, of half Spanish, half French blood, who gave me much information regarding the valley of the Mayu-tata and many notes from his journal. "Between the Madidi branch of the Beni and the Mayu-tata, besides a considerable district north of the latter river, all of the tribes speak the Tacana language. It is almost totally different from either Quichua or Aymará. The Tacanas cannot count beyond six. South of the mouth of the Madidi, and between the Unduma and Tegéque branches of the Beni, is found the mission of Ysiama. Near it passes an Inca road, running from the direction of Cuzco towards the bank of the Beni. The road is about 25 feet wide, and long lengths of it, well paved, are still visible. With reference to the lands occupied by the Tacana tribes, they are unsurpassed in beauty, as much for their topography as for their fertility and richness. They cover a broad space, about four degrees of latitude and about eight of longitude. The position is exceedingly agreeable—now extensive groves, which are suddenly replaced by delightful pasture lands, now by brooks, rivers, and lakes filled by numerous classes of fish. The most perfect salubrity of climate exists, despite the warm temperature. The groves are delightful and filled with all that gives pleasure—the leafy and productive almond-tree" (probably the Brazil nut), "the aromatic gum and the palm, ranging from the highest to the lowest, from the royal to the smallest. Hidden riches exist in these lands, grateful and filled with perfume, gum and wax abundant and varied. Here are found cabinet-woods, medicinal plants, and many other valuable productions, without mentioning the great mineral wealth of the district."

But the vast and beautiful region lying north-west of the Madidi and Beni rivers as far as the Aquiry branch of the Purus, and bisected by the Mayu-tata, was practically valueless to the commercial world, and cut off almost entirely from it, so long as the dreaded lower reach of the river Beni remained unexplored. When I descended the falls of the Madeira, the imagination of my boatmen, as I made them paddle a few miles into the mouth of the Beni, peopled this region with the most ferocious tribes of savages, and filled the river itself with obstacles to which those of the Madeira were only child's play. Augustin Palacios, Bolivian "Administrator of Rents" in the Beni province, had, in 1846, ascended the Beni to the rapid of Esperanza, near its mouth, and made a sketch of it. Above this was the *unknown*, with its terrors. At length, in 1880–81, Dr. Edwin R. Heath, an American who had been

professionally employed in my effort to open Bolivia to the commerce of the world, explored and mapped the Beni from Reyes to its mouth. The most of it was done in an old boat, 15 feet long and 4 feet wide, which Dr. Heath found submerged. He says,* "Bow and stern I could thrust my hand through. Pulling it on land, we caulked it with Indian corn husks, and plastered mud over them." With two Indian paddlers he accomplished his daring exploration successfully, but, all the way, found it difficult to keep his wretched craft from sinking. He solved a great geographical problem with the most primitive means that could be devised. The commercial effect upon the region which he opened was immediate and marvellous.

Previous to Heath's exploration, rubber trees had been discovered at Cavinas in 1869 or 1870, and, the quality of the rubber proving excellent, about 185 Bolivians were employed in the business of exploiting the neighbouring district. The product in 1880 was 104,000 lbs. Within two years from the exploration, the number of men engaged had increased to about 1500. Now they number several thousand, and have made prosperous settlements along the banks of the Beni, the Mayu-tata, the Orton, Abuna, the Aquire branch of the Purus, and numerous other streams which drain the vast region, now generally known as the Acre and Madre de Dios district, which comprises all of the great triangular area of Bolivia lying north-west of the Madidi and Beni rivers, and which is bounded on the north-east by Brazil and south-west by Peru. The precious gum, the best in the Amazon basin, is found here in such abundance that it has given large fortunes to the collectors. These, objecting to the export duties levied by Bolivia, recently made a revolution declaring their independence, relying upon their almost inaccessible position and the arms and ammunition which their wealth had enabled them to accumulate to defend themselves against any force which the government might be able to send against them. The energy of President Pando was equal to the occasion, and, a few months ago, the revolution was suffocated by prompt and efficacious military measures, carried out under enormous difficulties by my old friend Colonel Juan L. Muñoz.

Naturally, the disturbances in the Acre territory have, for 1899 and 1900, diminished the rubber exportation of Bolivia, which is estimated for the past year at about 2,000,000 kilos, worth about $2 gold per kilo.

M. Vicente Ballivian gives the Bolivian export as follows:—

For 1896	...	...	...	...	1,140,712 kilos.
„ 1897	...	...	...	...	1,674,216 „
„ 1898	...	...	...	...	3,155,955 „

Of this quantity for 1898, however, 2,000,000 kilos was the *estimated* product of the Acre region.

* See *Proceedings of the Royal Geographical Society*, June, 1883.

Some rubber from the Beni district is sent across the Andes and exported from the Peruvian port of Mollendo. The last report of the Bolivian Minister of Finance fixes the quantity for the first half of 1900 at 157,200 kilos, say 314,400 kilos for the year.

The export from Puerto Suarez *viâ* the river Purus for the last half of 1899 was 45,918 kilos, or say for the year 91,836 kilos. The export duties for the first quarter of 1900, collected at Villa Bella, at the confluence of the Beni and Mamoré rivers, which represent the quantity of rubber sent down the falls of the Madeira, amounted to $66,658 Bolivian silver, a sum which corresponds to about 416,612 kilos.

A Bolivian and Brazilian commission of demarcation is now engaged tracing the north-east boundary-line between Brazil and Bolivia, which, according to the treaty of March, 1867, between those powers, runs from the junction of the Beni and Mamoré directly to the extreme headwaters of the Javary river, which stream, throughout its course, is the boundary between Brazil and Peru.

There is no treaty of limits between Bolivia and Peru. The boundary, thus far more or less recognized, is the one which existed between the viceroyalties of Peru and Buenos Aires at the time of the independence from Spain. Peru claims territory to the east of the Inambari affluent of the Mayu-tata, while Bolivia could claim Sandia and Caravaya up to the Vilcanota inland range of the Andes, which were not incorporated in the bishopric of Cuzco.* The line will probably be defined ultimately on the principle of *uti possidetis*, and it seems probable that the one generally fixed by geographers as the proper boundary is more or less just. It is the same as is found on President Pando's map, extending along the course of the Inambari to its mouth, and thence directly to the headwaters of the Javary.

Colonel Pando's map bears evidence of having been made with scientific care. It gives us the names of the numerous affluents of the main rivers and their branches, while the eastern drainage system of the Caravaya range of the Andes, from Cuzco south-east, is shown in great detail—sources from which the Pando, Inambari, Marcapata, and other great south-western tributaries of the Mayu-tata draw their immense volumes of water. But the most remarkable feature of the map is the course given to the Paucartambo river, which is shown to be the main affluent of the Manu-tata or Madre de Dios. The Paucartambo, which rises in the Vilcanota mountains and runs north-west, leaving Cuzco only 30 miles to the left, in a straight line, has heretofore been considered as a branch of the Urubamba affluent of the

* Alto Peru, which formed part of the viceroyalty of Peru, was separated from this and incorporated with that of Buenos Aires by royal *cedula* of August 8, 1776. A royal *ordinanza*, of January 28, 1782, determined that the district of La Paz "should include all of the bishopric of that name and also the provinces of Lampa, *Caravaya* and Azangaro."

Ucayali. It seems, however, that the Paucartambo gives a great bend to the east, at about lat. 11° 20′, breaks through the mountains, and thence, under the name of the Manu, flows south-east to join the Mayu-tata. The course of the Manu was perhaps roughly mapped by Fiscarrald, when, in 1894, from his rubber estate, at the confluence of the Tambo and Urubamba, he ascended the latter stream to its Camisea branch, which enters it from the east, and in an hour's time crossed a narrow divide to a small affluent of the Manu, which he descended to the Mayu-tata. I have no knowledge of the Paucartambo ever having been explored between Cuzco and its heretofore supposed junction with the Urubamba. Its valley is occupied by savage tribes, and the river, as far as the point where Fiscarrald struck it, courses through the mountain gorges of one of the wildest and most broken sections of Peru. Like the Apurimac, it must be a succession of violent rapids and cataracts. It would be very interesting to have the *data* upon which the course of the Paucartambo, as now shown, is based. There are general reasons for the belief that Colonel Pando's map gives approximately its real course, and that he has made a correction of the first importance in the geography of South America.

The vigorous and brave defence which numerous savage tribes have made of the territory they occupy in the valleys of the Mayu-tata and Beni for hundreds of years, is perhaps the best proof of its value as an abode for man; and indeed it would be difficult, in any part of the world, to find a more beautiful and seductive region, where climate, fertility of soil, hill, dale, mountain slope, forest, rich savana, lake and river are more delightfully mingled, the whole teeming with varied animal life and abounding in such gifts as nature lavishly confers only when in her most prodigal and generous mood. It is this region, with its sturdy aboriginal people, which is now rapidly being brought under the lash of *civilization*. The map of President Pando shows all the principal rivers of this savage Arcadia, lays bare the mysteries which Inca, Spaniard, and his descendant warred for many a century to fathom, and the world owes to President Pando and his able coadjutors its recognition for an extremely valuable contribution to geographical knowledge.

THE NATIONAL ANTARCTIC EXPEDITION.

THE following are the instructions to the Commander of the Expedition and the Director of the Civilian Scientific Staff, as finally arranged between the Royal Society and the Royal Geographical Society, and accepted by the Joint Antarctic Committee.

INSTRUCTIONS TO THE COMMANDER.

1. The Royal Society and the Royal Geographical Society, with the assistance of His Majesty's Government, have fitted out an Expedition for scientific discovery and exploration in the Antarctic Regions, and have entrusted you with the command.

2. The objects of the expedition are (*a*) to determine, as far as possible, the nature, condition, and extent of that portion of the south polar lands which is included in the scope of your expedition; and (*b*) to make a magnetic survey in the southern regions to the south of the 40th parallel, and to carry on meteorological, oceanographic, geological, biological, and physical investigations and researches. Neither of these objects is to be sacrificed to the other.

3. The scientific work of the executive officers of the ship will be under your immediate control, and will include magnetic and meteorological observations, surveying and charting, and sounding operations.

4. Associated with you, but under your command, there will be a civilian scientific staff, with a Director at their head. A copy of his instructions accompanies these instructions to you.

5. In all questions connected with the scientific conduct of the Expedition you will, as a matter of course, consider the Director as your colleague, and on all these matters you will observe such consideration in respect to his wishes and suggestions as may be consistent with a due regard to the instructions under which you are acting, to the safe navigation of the ship, and to the comfort, health, discipline, and efficiency of all under your command. Those friendly relations and unreserved communications should be maintained between you which will tend so materially to the success of an expedition from which so many important results are looked for.

6. As the scientific objects of the Expedition are manifold, some of them will come under the immediate supervision of the Director and his staff; others will depend for their success on the joint co-operation of the naval and civil elements, while some will demand the undivided attention of yourself and your officers. Upon the harmonious working and hearty co-operation of all must depend the result of the Expedition as a whole.

7. The Expedition will be supplied with a complete set of magnetic instruments, both for observations at sea and on shore. Instructions for their use have been drawn up by Captain Creak, R.N., and yourself and three of your officers have gone through a course of instruction at Deptford with Captain Creak and at Kew Observatory. The magnetic observatory on board the *Discovery* has been carefully constructed with a view to securing it from any proximity to steel or iron, and this has involved considerable expense and some sacrifice in other respects. We therefore impress upon you that the greatest importance is attached to the series of magnetic observations to be taken under your superintendence, and we desire that you will spare no pains to ensure their accuracy and continuity. The base station for your magnetic work will be at Melbourne, or at Christchurch in New

Zealand. A secondary base station is to be established by you, if possible, in Victoria Land. You should endeavour to carry the magnetic survey from the Cape to your primary base station south of the 40th parallel, and from the same station across the Pacific to the meridian of Greenwich. It is also desired that you should observe along the tracks of Ross, in order to ascertain the magnetic changes that have taken place in the interval between the two voyages.

8. Geographical discovery and scientific exploration by sea and land should be conducted in two quadrants of the four into which the Antarctic Regions are divided for convenience of reference, namely the Victoria and Ross Quadrants. It is desired that the extent of land should be ascertained by following the coast-lines, that the depth and nature of the ice-cap should be investigated, as well as the nature of the volcanic region, of the mountain ranges, and especially of any fossiliferous rocks.

9. A German Expedition will start at the same time as the *Discovery*, and it is hoped that there will be cordial co-operation between the two expeditions as regards magnetic and meteorological observations, and in all other matters if opportunities offer for such co-operation. It is understood that the German Expedition will establish an observatory on Kerguelen island, and will then proceed to explore the Enderby Quadrant, probably shaping a course south between the 70° E. and 80° E. meridians, with the object of wintering on the western side of Victoria Land, whence exploring sledge-parties will be sent inland. The Government of the Argentine Republic has undertaken to establish a magnetic observatory on Staten island.

10. You will see that the meteorological observations are regularly taken every two hours, and also, in accordance with a suggestion from the Berlin Committee, every day at Greenwich noon. It is very desirable that there should, if possible, be a series of meteorological observations to the south of the 74th parallel.

11. As regards magnetic work and meteorological observations generally, you will follow the programme arranged between the German and British Committees, with the terms of which you are acquainted.

12. Whenever it is possible, while at sea, deep-sea sounding should be taken with serial temperatures, and samples of sea-water at various depths are to be obtained, for physical and chemical analysis. Dredging operations are to be carried on as frequently as possible, and all opportunities are to be taken for making biological and geological collections.

13. Instructions will be supplied for the various scientific observations; and the officers of the Expedition will be furnished with a manual, prepared and edited by Dr. George Murray, on similar lines and with the same objects as the scientific manuals supplied to the Arctic Expedition of 1875.

14. On leaving this country you are to proceed to Melbourne, or Lyttleton (Christchurch), New Zealand, touching at any port or ports on the way that you may consider it necessary or desirable to visit for supplies or repairs. Before leaving your base station you will fill up with live stock, coal, and other necessaries; and you will leave the port with three years' provisions on board, and fully supplied for wintering and for sledge-travelling.

15. You are to proceed at once to the edge of the pack, and to force your vessel through it to the open water to the south. The pack is supposed to be closer in December than it has been found to be later in the season. But this is believed to depend rather on its position than on the time; and the great difference between a steamer and a sailing vessel perhaps makes up for any difference in the condition of the pack.

16. On reaching the south water, you are at liberty to devote to exploration the earlier portion of the navigable season; but such exploration should, if possible, include an examination of the coast from Cape Johnson to Cape Crozier, with a view to finding a safe and suitable place for the operations of landing in the event of your deciding that the ship shall not winter in the ice.

The chief points of geographical interest are as follows: To explore the ice-barrier of Sir James Ross to its eastern extremity, to discover the land which was believed by Ross to flank the barrier to the eastward, or to ascertain that it does not exist; and generally to endeavour to solve the very important physical and geographical questions connected with this remarkable ice-formation.

17. Owing to our very imperfect knowledge of the conditions which prevail in the Antarctic seas, we cannot pronounce definitely whether it will be necessary for the ship to make her way out of the ice before the winter sets in, or whether she should winter in the Antarctic Regions. It is for you to decide on this important question after a careful examination of local conditions.

18. If you should decide that the ship shall winter in the ice, the following instructions are to be observed:—

(*a*) Your efforts, as regards geographical exploration, should be directed, with the help of depôts, to three objectly, namely, an advance into the western mountains, an advance to the south, and the exploration of the volcanic region.

(*b*) The Director and his staff shall be allowed all facilities for the prosecution of their researches.

(*c*) In carrying out (*a*) and (*b*), due regard is to be had to the safety and requirements of the Expedition as a whole.

(*d*) You have been provided by Sir Leopold McClintock and by Dr. Nansen with complete details respecting sledge-work both by men and dogs, and you have yourself superintended every item of the preparations connected with food, clothing, and equipment. You will be guided by the information and knowledge thus acquired.

(*e*) Lieut. Armitage, R.N.R., who has been appointed second in command and navigator to the Expedition, has had experience in the work of taking astronomical, magnetic, and meteorological observations during three polar winters. He has also acquired experience in sledge-travelling, and in the driving and management of dogs. You will, no doubt, find his knowledge and experience of great use.

(*f*) Early in 1903 your ship should be free from the ice of the winter quarters, and you will devote to further exploration by sea so much of the navigable season as will certainly leave time for the ship to return to the north of the pack ice. Having recruited at your base station, you will then proceed with your magnetic survey across the Pacific, and return to this country.

19. If, on the other hand, you should decide not to winter, you will bear in mind that it is most important to maintain scientific observations on land throughout the winter, and therefore, if you are able, in consultation with the Director, to find a suitable place for a landing-party between Cape Johnson and Cape Crozier, and decide that such a party can be landed and left without undue risk, the following instructions will apply:—

(*a*) You will land a party under the command of such person as you may appoint. Such party shall include the Director, the physicist, and one of the surgeons, and such other persons as you may consider desirable. But no person is to be left without his consent in writing, which you will be careful to obtain and preserve.

(*b*) You will give every practical assistance in establishing on land this party, which you will supply with all available requisites, including a dwelling hut, an observer's hut, three years' provisions, stores, fuel, sledges and dogs.

(*c*) No landing party is to be established on any other part of the coast than that between Cape Johnson and Cape Crozier, as it is above all things essential that in case of accident the approximate position of the party should be known.

(*d*) Before it is so late as to endanger the freedom of your ship, you will proceed north of the pack and carry out magnetic observations with sounding and dredging over as many degrees of longitude (and as far south) as possible, so long as the season and your coal permit, and then return to your base station, whence you will telegraph your arrival and await further instructions.

20. You are to do your best to let us have, and to leave where you can, statements of your intentions with regard to the places where you will deposit records, and the course you will adopt, as well as particulars of your arrangements for the possible need of retreat, so that in case of accident to the ship, or detention, we shall be able to use our best endeavours to carry out your wishes in this respect.

21. In an enterprise of this nature, much must be left to the discretion and judgment of the commanding officer, and we fully confide in your combined energy and prudence for the successful issue of a voyage which will command the attention of all persons interested in navigation and science throughout the civilized world. At the same time we desire you constantly to bear in mind our anxiety for the health, comfort, and safety of all entrusted to your care.

22. While employed on this service, you are to take every opportunity of acquainting us with your progress and your requirements.

23. In the unfortunate event of any fatal accident happening to yourself, or of your inability, from sickness or any other cause, to carry out these instructions, the command of the ship and of the expedition will devolve on Lieut. Armitage, who is hereby directed to assume command, and to execute such part of these instructions as have not been already carried out at the time of his assuming command. In the event of a similar accident to Lieut. Armitage, the command is to devolve on the executive officer next in seniority on the Articles, and so on in succession.

24. All collections, and all logs (except the official log), journals, charts, drawings, photographs, observations, and scientific data will be the joint property of the two Societies, to be disposed of as may be decided by them. Before the final return of the expedition, you are to demand from the Naval Staff all such data, which are to be sealed up and delivered to the two Presidents, or dealt with as they may direct. The Director of the civilian scientific staff will be similarly responsible for the journals, collections, etc., of the officers under his control. You and the other members of the Expedition will not be at liberty without our consent to make any communication to the press on matters relating to the affairs of the Expedition, nor to publish independent narratives until six months after the issue of the official narrative. All communications are to be made to us, addressed to the care of the Secretary of the National Antarctic Expedition, London.

25. The *Discovery* is not one of His Majesty's ships, but is registered under the Merchant Shipping Act, 1894, and is governed by it. Copies of this Act will be supplied to you. You will see that the officers and crew sign the ship's articles as required by the Act. The scientific staff will not sign articles, but are to be

treated as cabin passengers. You must be careful not to take more than twelve persons as passengers.

26. The vessel has been covered by insurance, and, in the event of her sustaining any damage during the voyage, to recover the claim from the underwriters, it will be necessary for you to call in the services of Lloyd's agent, or in his absence, an independent surveyor, at the first port of call, in order that the damage may be surveyed before repairs are effected. His survey report, together with the accounts for repairs and supporting vouchers, should be sent to us by first mail, together with a certified extract from the official log reporting the casualty.

In the event of damage occurring after you have left civilized regions, precise particulars should be entered in the log, and the damage should be surveyed and repaired as soon as you return to a port where Lloyd's agent, or other surveyor, is available.

27. The *Discovery* is the first ship that has ever been built expressly for scientific purposes in these kingdoms. It is an honour to receive the command of her; but we are impressed with the difficulty of the enterprise which has been entrusted to you, and with the serious character of your responsibilities. The Expedition is an undertaking of national importance, and science cannot fail to benefit from the efforts of those engaged in it. You may rely upon our support on all occasions, and we feel assured that all on board the *Discovery* will do their utmost to further the objects of the Expedition.

Instructions to the Director of the Civilian Scientific Staff.

1. The Royal Society and the Royal Geographical Society have approved your appointment as Director of the Civilian Scientific Staff of their Antarctic Expedition.

2. A copy of the instructions to the Commander of the Expedition accompanies these instructions, which are supplemental to them. You will see from the instructions to the Commander what the objects of the expedition are, and your position relatively to him.

3. You will direct the scientific work of the gentlemen who have been appointed to assist you.

4. The names of the gentlemen associated with you are as follows: (1) Mr. Hodgson (*Biologist*); (2) Mr. Shackleton (*Physicist*). The services of the two medical officers will be at your disposal for scientific work when not engaged on the work of their own department, namely, Dr. Koettlitz (*Botanist*), and Dr. Wilson (*Zoologist*).

5. You will note that the Commander of the Expedition has been instructed to communicate freely with you on all matters connected with the scientific objects of the Expedition, and, as far as possible, to meet your views and wishes in connection with them. The Societies feel assured that you will co-operate and act in concert with him, with a view, as far as possible, to secure the success of an enterprise which it is hoped will be attended with important results in the various branches of science which it is intended to investigate.

6. All collections, logs, journals, charts, drawings, photographs, observations, and scientific data will be the joint property of the two Societies, to be disposed of as may be decided by them. Before the final return of the Expedition, you are to demand from the staff under your control all such data, which are to be sealed up and delivered to the two Presidents, or dealt with as they may direct. On the return of the Expedition, you will be expected to superintend the distribution of specimens to specialists approved of by the two Councils or their

representatives, and to edit the resulting reports. You will also be expected to contribute a report on the scientific results of the Expedition for the official narrative. As it may be desirable during the progress of the voyage that some new scientific discovery should be at once made known in the interests of science, you will, in such a case, inform us of it by the earliest opportunity.

7. You and the other members of the Expedition will not be at liberty, without our consent, to make any communication to the Press on matters relating in any way to the affairs of the Expedition, nor to publish independent narratives until six months after the issue of the official narrative. All communications are to be made to us, addressed to the care of the Secretary of the National Antarctic Expedition, London.

8. Should any vacancies in the scientific staff occur after the Expedition has sailed from England, you may, with the concurrence of the Commander, make such arrangements as you think desirable to fill the same, should no one have been appointed from England.

9. You and the members of the scientific staff will be cabin passengers joining the Expedition at your own risk, and neither the owners nor the captain are to be responsible for any accident or misfortune which may happen to you. You will obtain from each member a letter to this effect.

The instructions are signed by the Presidents of the two Societies.

Mr. George Murray, F.R.S., Director of the Botanical Department of the British Museum, has been appointed Director of the Civilian Scientific Staff. Mr. Murray will proceed to Melbourne or Lyttleton with the *Discovery*, but will not be required to go further. Meanwhile, on the voyage out, he will, in conjunction with the Commander, appoint a principal member of the Scientific Staff who shall carry out the scientific work on the lines laid down by the Director. On the return of the Expedition Mr. Murray will, as Director, be the editor of the scientific results.

As in the case of the British Expedition of 1875–76, a manual has been prepared for the use of the staff of the expedition, which is thus provided, in a handy form, with information likely to prove of value in the course of the scientific investigations. The 'Antarctic Manual' is ably edited by Mr. George Murray, Director of the Civilian Scientific Staff, and includes contributions by a large number of experts on the various branches of science on which research will be made. These, which form the first part of the manual, may be regarded as instructions to the staff on the methods to be employed, while the second section consists of reprints or translations of narratives of antarctic voyages not generally accessible. Lastly, an Antarctic Bibliography, certainly the fullest and most complete ever yet prepared, has been supplied by Dr. H. R. Mill.

A brief indication only of the various subjects treated of in the first section can be given here. Each contribution is by a recognized authority on the subject with which it deals, and a glance at the list of names is sufficient to show the solid value of the instructions supplied. A glossary, by Sir Clements Markham and Dr. Mill, of nautical and

scientific terms used in reference to ice is first given, after which come contributions on astronomy, by the superintendent of the Nautical Almanac; on tidal observations, by Prof. G. H. Darwin; on pendulum observations, by Prof. R. T. Glazebrook; and on terrestrial magnetism, by Captain E. W. Creak. An important section is the programme for international co-operation during the period in which the Expedition will be at work, which, if carried out, should add greatly to the value of the results. The section on climate includes, besides notes by Mr. R. H. Scott, Dr. Supan, etc., an epitome of the observations taken on board the ships of recent expeditions to the antarctic. Commander Wilson-Barker supplies notes on wave-observing, Prof. Schuster on the aurora, and Lord Kelvin on atmospheric electricity. Mr. J.Y. Buchanan gives a series of general hints on chemistry and physics, paying especial attention to the methods of temperature observation and meteorological observations generally. Geology is dealt with by Dr. W. T. Blanford, volcanoes by Prof. Judd, and ice-observations by Profs. Bonney and J. W. Gregory. Notes on the different branches of zoology are given by various specialists, while the editor is responsible for the section on botany. Lastly, valuable hints on sledge-travelling are supplied by Admiral Sir Leopold McClintock.

The geographical section supplies narratives of antarctic voyages which are not readily accessible otherwise, either as forming parts of voluminous scientific reports, as those of Balleny, D'Urville, and Wilkes, or from having hitherto remained in manuscript. To the latter class belong the narrative of Captain John Biscoe, and the log of Balleny's second mate, both of which were presented to the Royal Geographical Society many years ago by Mr. Charles Enderby.

The Antarctic Bibliography, compiled by Dr. Mill, is the first so far published which makes any claim to completeness, and though no doubt a certain amount of antarctic literature exist which is not included, it is believed that no paper of any importance has been omitted. The arrangement is chronological, the earlier years, for which of course the entries are very limited in number, being grouped together, while, since the beginning of the nineteenth century, each year has its own heading. Dr. Mill also gives a useful chronological table of antarctic voyages, and indices both to the names of authors and to those of antarctic ships. The bibliography, which has involved much labour and research, should prove of great value, not only in connection with the present expedition, but to geographical students generally.

REVIEWS.

ASIA.

A Sikhim Road-Book.*

We note that the forms Sikkim and Kangchinjunga are here preferred to those used in the more recent surveys, Sikhim and Kanchinjinga. It seems desirable that the Government of India should adopt finally a single form of local names. Another detail which calls for remark is the discrepancy between many of the heights given on the sketch-map attached to this volume and those in the large-scale (2 miles to 1 inch) Transfrontier Maps. This affects mostly the peaks north of Kanchinjinga. These, we gather, were measured independently by the late Captain Harman in the first instance, and the heights assigned them do not rest, therefore, on the same authority as those of the peaks visible from the plains, which were included in the great general Trigonometrical Survey of India.

Take, for example, the three summits immediately north of Kanchinjinga. In the Transfrontier sheet the heights given are 23,320, 23,360, and 24,210; in Captain O'Connor's map, 23,350, 23,470, and 24,090. It would be interesting to orographers to know on what principle and by whom these alterations were made. They first appeared, we believe, in the 8-mile-to-the-inch Transfrontier sheet No. 7. It is curious that in that sheet the height of Siniolchum is omitted. In the height 19,650 given the Chorten Nima pass on Captain O'Connor's map, the text seems to show that an 8 should be substituted for the 9. The height of the Yeumtso La is reduced from 17,040 to 15,800 feet, and that of the Guicha La from 16,430 to 15,300 feet. These alterations need confirmation. The height of the termination of the Zemu Glacier, or rather, of the confluence close to it, is given as 12,800 feet: 13,000 feet may safely be quoted by geographers as the lowest limit of glaciers in this region.

The present volume supersedes an earlier edition, which had become obsolete. The primary object of its compilers has been, apparently, to afford such information as might be useful in the case of military operations on the Tibetan frontier, or a march on Lhasa. A number of routes are described in more or less detail as far as concerns the difficulties of the ground, the character of the paths, the nature of camping-grounds, and the means of crossing torrents. Neither scenery nor scientific observation find much place in the notes here provided. But the practical information afforded will naturally be of great use to

* 'Routes in Sikkim,' compiled in the Intelligence Branch of the Quarter-master General's Department in India, by Captain W. F. O'Connor, Royal Garrison Artillery. Calcutta, November, 1890.

travellers. The routes described range from the well-known horse-paths round Darjeeling to the remote passes east and north of Kanchinjinga. Perhaps the most novel piece of exploration recorded is Captain O'Connor's passage of the Chorten Nima pass in 1896, and his journey, within the Tibetan frontier, from it eastwards to the Kongra La and Giaogong. Captain O'Connor was the first European to visit the head of the Lhonak valley, which he describes in the following terms :—

"The whole of the district drained by the Naku Chu and Langpo Chu is called Lhonak, meaning 'the black south,' and is regarded by the Tibetans as their own property, and they very much resent the appearance there of any foreigner. . . . The actual head of the valley is a chaotic mass of glacier and moraine. There is said to be a pass, the Jonsong La, leading out of this valley into Nepal, but I was unable to ascertain whereabouts it lay; from the general configuration of the country it must be extremely lofty and difficult."

It is curious that Captain O'Connor should make no reference either to the accounts given by the native explorers, Rinsing and Chandra Das, of the Jonsong La, or to its passage in 1899 by an English party, of which Mr. C. Dover, of the Public Works Department in Sikhim, a contributor to the present road-book, was a member. It is true that it is not likely, judging from Mr. D. Freshfield's description (*Alpine Journal*, August, 1890) that this route will prove of much use for military purposes. We may note that Mr. Freshfield has stated that the gap to which he was led by Rinsing, the native explorer, as the Chorten Nima La, was not that pass, but a gap further east, connecting two sources of the Teesta (*Alpine Journal*, May, 1901).

The accounts of the Kang La and Guicha La routes are meagre; and the former pass is a long way from either Kabur or Kabru. On what may be called by comparison the main roads of Sikhim and the approaches to the Chumbi valley, the information given appears to be both accurate and sufficient. A route to Lhasa, an extract from an old native surveyor's report, may excite the envy and emulation of European travellers.

Lists of the bungalows kept up—perhaps this is hardly the right word, considering the condition of many of those in Independent Sikhim—and of circular tours, which may be conveniently made from Darjeeling, are added as an inducement to travellers. Distances are given in miles; in one case between Yoksun and Jongri, three marches are allowed for 17 uphill miles, a significant relation between time and space. Mr. Dover, however, and a worn-out troop of coolies descended them in one day in 1899.*

* With regard to the discrepancy in heights referred to above, and the omission of that of D_2, Mr. Douglas Freshfield sends us the following note, which he has recently received from Colonel St. G. Gore, R.E., the Surveyor-General of India :—

The Siberian Railway.

Among recent books on Russian Asia the most important is certainly the 'Guide to the Great Siberian Railway,' published by the Ministry of Ways of Communication (St. Petersburg, 1900). This thoroughly business-like work has been prepared under the supervision of Prince Khilkov, the Minister of Ways of Communication; it has been edited by MM. Dmitriev-Mamonov and Zdziarski; and the English translation has been made by Mlle. Kukol-Yasnopolski. It should be impossible for any one, even in England, to write in future about Siberia as it is without reference to this volume, which combines the gazetteer, the guide-book, and the album, with a careful industry and a discerning taste not too frequent. As to illustrations;—it contains 360 photogravure pictures of Siberian scenes and types, 4 maps of the country, 3 plans of towns, and 2 phototypes, and the execution of these is a credit to the Artistic Printing Society of St. Petersburg. The text opens with a geographical and historical review of Siberia, on pp. 1–52; an account of the construction of the Great Siberian Railway follows (pp. 53–80); and next we have a detailed account of the various sections of the line and the various belts of country from west to east through which it passes; *e.g.* from Samara to Zlato-ust (pp. 81–113), from Cheliabinsk to Ekaterinburg (pp. 113–120), from Ekaterinburg to Tiumen (pp. 120–126), from Cheliabinsk to the Ob (or the West Siberian line, pp. 173–218), from the Ob to Irkutsk (or the Mid-Siberian line, pp. 261–306), from Irkutsk to the Baikal Lake (pp. 307–313), from the Baikal to the Amur (or the Trans-Baikal line, pp. 363–376), from Khabarovsk to Vladivostok on the Pacific (or the Ussuri line, pp. 441–472), from the Upper Amur to Vladivostok and Port Arthur through Manchuria (the Manchurian or 'East Chinese' line, pp. 481–500). Besides these chapters, expressly devoted to the railway and its immediate neighbourhood, excursions are made to other regions, in dealing with the general questions of the development of Russian Asia; thus the island of Sakhalin is described on pp. 473–480, the Amur territory and waterway on pp. 377–418, Lake Baikal on pp. 327–338, the West Siberian plain and the Kirghiz and Baraba steppes on pp. 127–172. At the end of

"As to heights, those on the 4 miles to the inch map by Colonel Tanner, published in 1886, are more reliable than those published on the 2 miles to the inch map of 1885 [N.E. Trans-Frontier, Sheet $^{NW}_{1}$]. The cause of the difference is a recalculation of the triangles due to some new values being introduced at the bases.

"When the two signs △ and ○ appear on the same sheet, the triangle means that the point was a station of observation, and the theodolite was set up there; points marked with a circle were only fixed by the intersection of rays.

"The omission of the height of D_2 on the more recent map was, I think, a chance omission. Colonel Tanner fixed the point on the N.W. spur, and appears to have omitted the height of D_2, which had been previously determined (22,570).—St. G. Gore."

each section a serviceable bibliography is given; in reference to the Amur watercourse, so important as the riverine link between the two railway termini at Stretensk and Khabarovsk, the settlements and stations on the river-side are marked and described in great detail, especially in relation to the condition of the main stream and its affluents; and at the conclusion of the volume an appendix is added of fares and time-tables between St. Petersburg and the Pacific, not only by the railway, but by the fresh-water routes, on the Irtish, Ob, Tom, Angara, Baikal Lake, Amur and Ussuri (pp. 501–520). Among the illustrations, special attention may perhaps be directed to the photographs of the greater railway bridges, such as those over the Ob, Yenisei, Tobol, Tom, Khor, Ussuri, Irtish, etc.; see pp. 85, 91, 96, 180, 182, 191, 213, 268, 272, 287, 292, 449, 453, 454, 456, and 457, for the chief examples of these truly remarkable constructions.

The least full and satisfactory portion of the *Guide* is that given to the Trans-Baikal railway; but in view of the fact that this portion of the line was not entirely completed by the date of publication in 1900, it would perhaps be unreasonable to expect more. A photograph, *e.g.*, of the great bridge over the Selenga, could scarcely be expected before its inauguration. The following illustrations (all photographs), with the accompanying letterpress, may also be commended as giving some idea of recent progress towards civilization:—p. 361, the tea-bazaar in Kiakhta, on the Russo-Chinese frontier; p. 329, the ice-breaker dock near Listvennichnaya, on Lake Baikal; pp. 317–319, the Archæological and Anatomical Museums, the Library of Count Stroganov, the Physical Cabinets, Clinics, Students' College, and General University Buildings in the University of Tomsk; p. 316, the Trinity Cathedral in Tomsk; pp. 304–311, various churches, houses, schools, etc., in Irkutsk, and especially the Theatre and the Museum of the East Siberian branch of the Imperial Geographical Society; p. 279, the railway technical school in Krasnoyarsk; p. 251, the Museum of the Khaitin china manufactory; pp. 232–234, views in Barnaul and Biisk; pp. 216–217, views of the Ob-Yenisei canal and of an Ob steamer; pp. 199–202, workshops at Omsk; p. 179, the medical and feeding station for emigrants near Kurgan; p. 130, a museum in Tobolsk; pp. 124, 125, the steamers' quay and the museum of the modern school in Tiumen; pp. 117–20, views in Ekaterinburg (not perhaps quite worthy of that charming town), especially the Cathedral and Court of Justice; p. 98, the Miniar ironworks; p. 101, the Satka ironworks; p. 99, a railway cutting in the Urals; p. 181, the landing-place at Nikolaievsk, on the Amur; p. 34, a moveable school at an emigrant station; p. 455, a landing-stage on the Iman; pp. 378–383, mail and other steamers on the Amur; pp. 17 and 413, the mole and winter anchorage of steamers at Blagoveshchensk; p. 446, the offices of the Ussuri section of the Siberian railway at Khabarovsk;

p. 464, the railway terminus at Vladivostok; pp. 76, 77, 62, 218, 440, views of the *train de luxe* and its separate carriages. Excellent bibliographies are added at the end of each section; and statistical tables are to be found here, not only of areas and populations, but of animal and mineral resources and products, even lists of the chief mineral springs, as well as of the newspapers and manufactories of separate towns and districts, and of the steamers and barges on the inland waters, with their freights and tonnage (cf. pp. 345, 357, 401, etc.). The purport of this volume could hardly be better expressed than in the words of Mr. J. Young Simpson in his interesting and fair-minded 'Side Lights on Siberia:' "at once the reservoir of the Russian Empire and its cesspool. In the latter aspect it has been known of old time, the former distinction has only lately come to light." For here we have not only an appreciation of the value of the country, its hidden treasures and its fertile soil, but also a tacit recognition of the inadequacy and folly of certain older conceptions.

C. Raymond Beazley.

Leroy Beaulieu on Siberia.

M. Pierre Leroy Beaulieu's work on Siberia, Japan, and China, translated into English under the title of 'The Awakening of the East' (Heinemann, 1900, pp. xxvii., 589), appears to be one of the most serviceable, compact, and meritorious little books that have recently appeared on Asiatic subjects. Mr. Henry Norman contributes a preface. M. Leroy Beaulieu's Russian chapters follow a customary arrangement, beginning with history, and proceeding to description: chap. i. The Origins of Russian Expansion in Siberia, and the Natural Characteristics of the Country, pp. 1–8; chap. ii. The Land and its Inhabitants, pp. 9–16; chap. iii. Agricultural Siberia and the Rural Population, pp. 17–26; chap. iv. Mineral Resources and Industries, pp. 27–30; chap. v. Siberian Commerce and the Transport of Tea, pp. 31–37; chap. vi. Siberian Towns (treated with extreme brevity), pp. 38–42; chap. vii. Immigration, pp. 43–55; chap. viii. Means of Communication, pp. 56–63; chap. ix. The Siberian Railway, pp. 64–70; ch. x. The Railway through Manchuria, pp. 71–75; chap. xi. The Altered Relations between Europe and the Far East resulting from the Siberian Railway, pp. 76–80. On the whole, this is a trustworthy summary of the most modern knowledge on Siberia; M. Leroy Beaulieu has accumulated a great mass of facts, sifted them well, and packed them closely; his remarks are usually judicious, and sometimes acute; but occasionally he ventures on strange theories. Thus Peter the Great's ambition to expand his empire westward by the conquest of *Constantinople* (p. 3), is a little wild; and the Russians, taken as a whole, are not 'of Oriental

extraction,' though the Mongol and other Oriental strains in their blood are doubtless important.

C. R. B.

Hosie's 'Manchuria.'

Mr. Alexander Hosie's study of 'Manchuria: its People, Resources, and Recent History' (Methuen, 1901, pp. xii., 274) gives a record of a journey from Newchwang to Lake Baikal (pp. 73–134), as well as an account, evidently compiled with great care and knowledge, of the inhabitants and administration, physical features and climate, agriculture, animal and mineral products, special industries and trade, of Manchuria (pp. 135–262). Mr. Hosie at first intended to follow the track of the Manchurian railway from Port Arthur to the Amur, taking advantage of the sections already completed or in construction; but being obliged to alter his plans, he travelled round to Vladivostok, thence by rail to the Amur at Khabarovsk, and so by steamer up the river to the terminus of the main Siberian line at Stretensk. Good photographic illustrations are given of the British consulate at Newchwang, of the ceremony of cutting the first sod on the Russian-Manchurian line, August 28, 1897, of various scenes on the same, as well as at Port Arthur, Vladivostok, and Khabarovsk; at Stretensk and Blagovechchensk; and on the upper and lower Amur. A large-scale map of Manchuria, based on Russian sources—in default of any good English plan of the whole country—is added at the end of the volume. The execution of this does not strike us as at all on a par, in clearness and legibility, with the amount of accurate information contained. The view of recent events in Manchuria, in chapter ii., and of the earlier history of the Manchurian boundary between China and Russia in chapter v., is accompanied by extracts from various treaties—*e.g.* of 1689, 1858, 1860, 1895, and 1898—and seems free from any of those gross errors so often committed by writers on recent Far Eastern history. A few small mistakes occur, *e.g.* on p. 47, Pi-tzu-wo, on the frontier of the Russian leasehold, is called a village on the *west* coast of the Liao-tung peninsula.

Objection may be taken to some of Mr. Hosie's spelling of Russian names and words; *e.g.* Blagove*sch*ensk (where *sch* is not enough for the *shch* letter), *H*arbin, *H*arbarovsk, and para*h*od (where the *kh* letter is treated rather as if one were to insist on spelling *corf* or *chuff*), and Vladivostock (where the eternal *c* intrudes itself against rhyme and reason). While Mr. Hosie gives (p. 95) a favourable account of the sectional railway between Vladivostok and Khabarovsk, he has many criticisms on the branches of the Russian trunk line in Manchuria and the trans-Baikal region.

C. R. B.

Seebohm's 'Birds of Siberia.'

Mr. Henry Seebohm's two works, published in 1880 and 1882, under the titles of 'Siberia in Europe' and 'Siberia in Asia,' have just been re-issued in a single volume, 'The Birds of Siberia: a Record of a Naturalist's Visits to the Valleys of the Petchora and Yenesei' (John Murray, 1901). For ornithologists this work, although docked of the old footnotes on the geographical distribution of birds, etc., must always have a considerable interest; it may be regretted that in the process of condensation the work was not more strictly confined to its scientific side. Mr. Seebohm knew a great deal about birds, but he neither knew nor cared to know more about Russia than the ordinary English traveller. Russia, it might have been remembered, has changed more in the last twenty years than any other European state; and, apart from this, it seems regrettable that an interesting branch of natural history should be made the vehicle for the expression of political or religious opinions.

C. R. B.

AMERICA.

Keane's 'Central and South America.'

Volume I. of 'Central and South America,' by Prof. A. H. Keane, edited by Sir Clements Markham, K.C.B., and published by Mr. Edward Stanford, is a valuable and richly illustrated compendium of the geography of South America. It compresses a great variety of information into a small space, and is a welcome book to any student who desires to gain a general knowledge of the South American states, their ethnological history, present population, orography, river systems, plains, forest areas, climate, flora, fauna, topography, products, and political status. Moreover, it gives a short historical retrospect of each state, including its discovery, conquest, settlement and colonial administration, religion, natural resources, and mineral wealth. It is, therefore, a geography in its broadest sense, well classified and comprehensive. Although, here and there, errors of detail may appear, they are incident to so extensive a subject, where the author has naturally had to depend for much of his data upon numerous travellers and explorers who have, at times, failed in accuracy of observation.

Mr. Keane, in common with other writers, calls attention to the vast areas of Venezuela which remain unexplored, especially the Guayana region. In speaking of the Llanos, he says, "No language could convey a true picture of the varied beauties of the scene—the harmonious effects of light and shade; the blending of the various green, blue, and purple tints flitting in the sunlight over the vast panorama; the stately palms gracefully fanning the glowing atmosphere, with their majestic crowns of broad and shining foliage. . . . Judged by the proportion of urban to

rural population, Venezuela must take rank with the most backward countries of the world; it is still mainly inhabited by scattered rural communities and nomad tribes, with scarcely any large industrial commercial centres."

He gives us an interesting description of the orographic systems of Colombia and Ecuador, and discusses the vexed question of parallel Cordilleras in the latter country. "If the parallel chains have thus to be removed, the sequence of peaks on both sides stands out all the more conspicuously, and constitutes that magnificent 'avenue of volcanoes' which is unrivalled for magnitude and sublimity in the whole world. Here are grouped as many as twenty crests, and a much larger number of peaks, cones, and domes over 15,000 feet high." He also gives considerable data regarding the river system of Perú, especially of the Marañon, Huallaga, and Ucayali, which last-named stream he believes might well be deemed, from "length and volume, to be the true upper course of the Amazon." It resembles in this respect its great rival the Mississippi in relation to its Missouri branch. The Pongo de Manseriche, where the Marañon breaks free from the mountains, is, according to Mr. Keane, 540 feet elevation above sea-level. It seems to have as many elevations as there are travellers and explorers who have visited it. As its height largely governs the slope of the Amazon main river, it may be well to refer to "South America: an Outline of its Physical Geography,"* where the question of the incline of the monarch river is discussed at some length. The author believes that the height of the Pongo de Manseriche above sea-level is not a fourth part of the elevation assigned to it by Mr. Keane, and that the Amazon is not so much a river as it is a gigantic, island-filled reservoir extending from the sea to the base of the Andes, and, in the wet season, varying in width from 5 to 400 miles.

In treating of Bolivia, Mr. Keane justly calls attention to the remarkable lake Titicaca, the drainage basin of which "has an area of over 40,000 square miles; when flooded it must have been the largest lake, as well as the chief reservoir of the largest river in the world." Its shrunken remains now have an area of 3300 square miles. It is probable that, at no very remote geological period, it had two outlets—one southward, through the Argentine provinces of Catamarca, Rioja, and Mendoza, to the Colorado, swelling this river into great proportions, and reaching the Atlantic at the present Bahia Blanca; and a second outlet to the Beni and Amazon, through the La Paz river, which has cut such a profound cañon round the southern base of Mount Illimani.

Chile, which has failed to "attract to its shores a share of the stream of European migration," is treated at considerable length by Mr. Keane, and in bold outline he gives us a most valuable description of the country. No less can be said of the Argentine Republic, Brazil, and the smaller South American states. In fact, the whole work is teeming with

* The *Geographical Journal*, April, 1901.

useful data, so varied that one might wish that some other title had been selected for it. The meaning of the word *geography* has been so expanded of late years, that authors seem to seek its shelter for subjects too remotely related to it and to overtax its too generous hospitality.

It is clear, from the text of Mr. Keane's work, that neither he nor the editor, Sir Clements Markham, could have had anything to do with its numerous accompanying maps, except perhaps the "ethnological" one. An attempt has been made in them to decide for the British Government the boundary-line question between Chile and the Argentine Republic, now *sub judice*. They give to Chile all the territory she claims. It is even more strange to find the limits between Chile and Bolivia treated with the same disrespect of treaties; for, in this case, an entrant angle is thrown into Bolivia, assigning to Chile a large piece of valuable territory, in direct contravention of the truce between those countries of April 4, 1884, and the "Treaty of Peace and Friendship" of May 18, 1895, which followed.

It seems a pity that in so excellent a compendium of South American geography as Mr. Keane has produced, more care has not been exercised to ensure accurate maps.

GEORGE EARL CHURCH.

OCEANOGRAPHY.

THE "VALDIVIA" EXPEDITION.

Under the title 'Aus den Tiefen des Weltmeeres,' the firm of Gustav Fischer, of Jena, has published a volume from the pen of Prof. Chun, containing a popular narrative of the oceanographical cruise of the German steamship *Valdivia*, during the years 1898–99. The progress of the expedition during its voyage, and the preliminary results of its work, so far as they have as yet appeared, have been referred to from time to time in the *Journal*, and it is therefore unnecessary to give here a detailed account of the contents of Prof. Chun's book; suffice it to say that the subject falls naturally into three divisions: (1) an account of the outfit and equipment of the expedition; (2) a narrative of the cruise and description of the islands and points visited; and (3) an outline of the deep-sea fauna. The story is told with unfailing interest and charm, lightened every now and then by a touch of real humour; and the wealth of splendid illustrations—6 chromolithographs, 8 heliogravures, 32 full-page blocks, 2 maps, and 389 photographs and sketches in the text—make the book almost unique of its kind. The volume should do much to increase the interest taken in deep-sea research in Germany, and so to give the proper stimulus essential for the prosecution of such investigations, which are necessarily national undertakings.

ON SAND-WAVES IN TIDAL CURRENTS.*

By VAUGHAN CORNISH, D.Sc. (Vict.), F.G.S., F.C.S., F.R.G.S., Associate of Owens College.

In continuation of my investigation of the phenomena of waves, I recommenced observations at Barmouth, North Wales, in December, 1899. My attention was soon attracted by the appearance of the sandbanks in the lower portion of the Mawdach estuary, which have the wavy surface shown in Fig. 1 (Plate I.). This photograph was taken on December 31, from an elevation of about 150 feet on the northern shore of the estuary looking south-east, from a position about one furlong above the railway bridge. The time was near low water of a fairly large tide, not yet the full springs, but nearer the springs than the neaps. The highest part of the shoal about halfway across the estuary is stated to be about 9 feet above low water at spring tides which gives about 7·5 feet above the water-line in the photograph. Below the water-line, on the side nearest the camera, the sand, according to the Admiralty chart, slopes down somewhat steeply for a vertical distance of 22·5 feet. At the railway bridge the engineers find in the main channel another 35 feet of sediments overlying the rocky foundation on which they bed the

FIG. 2.—TIDAL SAND-RIDGES, BARMOUTH, BELOW BRIDGE.

iron cylinders. The ridges shown in the photograph are about 18 feet from crest to crest. Fig. 2 is a nearer view of ridges taken from the railway bridge looking west on January 14, 1900, at low water. The troughs between these ridges would only be dry at exceptional tides. The distance from ridge to ridge is about 26 feet, and the height from trough to crest is in some cases as much as 2 feet.

The surface of the shoal is normally in this condition, viz. in ridges ranged across the estuary. The appearance of the surface was quite similar six months later (June 13, 1900), during a second visit to Barmouth. In the interval of six months the sandbanks had shifted a good deal in shape and position, but there was no such striking change in the general appearance of the ridges.

The ridges are not symmetrical, but have a gentle and a steeper slope, the latter a talus of about 31°. In well-developed ridges the summit is not coincident

* Read at the Royal Geographical Society, June 10, 1901.

Fig. 1. Tidal Sand Ridges at Barmouth.

Fig. 18. Interpenetrating Ridges on the Dun Sands.

Fig. 19. Ridges on the North Goodwin, looking South

Fig. 12. A Chain of Pools, Annat Sand, Montrose.

with the top of the cliff, but some distance on the weather side, which is slightly concave in its lower and convex in its upper portion.

I was soon able to assure myself that these ridges were caused by the tidal currents, a conclusion which the observations here recorded will show to be inevitable. In 1891, Prof. Osborne Reynolds, F.R.S., had drawn attention to "tidal sand-ripples." He writes *—

"The large tidal sand-ripples below low water in the model estuaries, with the flood and ebb taking the same course, constitute a feature which it is impossible to overlook, yet the existence of corresponding ripples had been entirely overlooked in actual estuaries until they were found to exist when they were looked for, having been first seen in the models. The reason that they were overlooked before is, no doubt, explained by the fact that the bottom is not visible below low-water mark in actual estuaries; but this is not all. In the estuaries these ripples, where found, have been confined to the bottoms and sides of the narrow channels between high sandbanks. . . ."

I had now encountered "tidal sand-ripples" under conditions different from these, and more favourable to detailed examination. I accordingly decided to investigate them further, and to ascertain, among other things, what preserved them from obliteration during the recession of the tide. The localities visited in connection with the work, besides Barmouth (North Wales), were Grange (Lancs.); Findhorn, N.B.; Montrose, N.B.; Mundsley (Norfolk); the Goodwin Sands; Pegwell Bay (Kent); the Severn, between Gloucester and Severn tunnel; and Aberdovey (North Wales).

Observations at Barmouth (North Wales).

December 30, 1899, to January 18, 1900.

The approximate form and extent of the shifting sands of the Mawdach estuary and of the foreshore are shown in Fig. 3, reproduced from the Ordnance Survey Map. Particulars of the tides at the entrance (Ynys y Brawd, south-east point) given on Admiralty Chart 1484 are: H.W.F. and C. $8^h\ 51^m$; sp. rise 14 feet 4 inches: Np. rise 10 feet 4 inches. Np. range 7 feet 4 inches.

The Barmouth boatmen reckon that the tide flows for five hours and ebbs seven hours. The current seems to turn as soon as high water is reached. The maximum velocity in the deep channel under the railway bridge is great, and when the tide is running strongly there are many conspicuous eddies in the estuary. Some views of the tidal sand-ripples have already been given in the introductory paragraphs.

The following measurements were taken on January 9 on the shoal above the railway bridge, shown in Fig. 1 (Plate I.), proceeding up the estuary in a line at right angles to the ridges. The line along which these measurements were taken would have been somewhat less than halfway up the picture in Fig. 1 (Plate I.) (beyond the first lane of water), and parallel with the bottom of the picture. The ridges here had their steeper face up stream—they "face" with the flood tide. The distance from ridge to ridge is called the wave-length (L).

The columns of figures are arranged so as to divide the series into five portions. The average wave-lengths are somewhat greater in the first and last columns, which are near the exit and entry of the shoal. The differences between successive wave-lengths is least where the wave-length is least, near the centre of the shoal.

* 'Third Report of the Committee appointed to investigate the Action of Waves and Currents on the Beds and Foreshores of Estuaries by Means of Working Models.' B.A. Report, 1891, Cardiff Meeting.

Rowing across the main channel, I landed on the next shoal, near to and rather above Coes Faen, and took a second series of measurements at right angles to

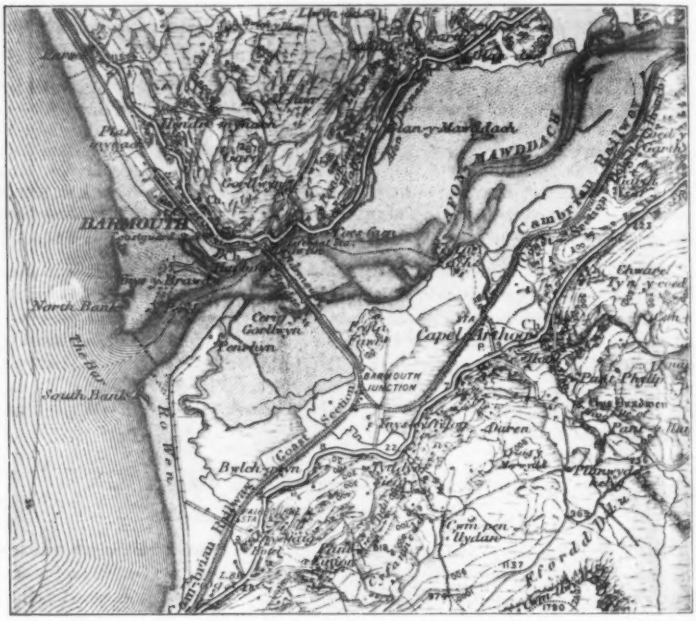

FIG. 3.—MAWDACH ESTUARY. SCALE, 1″ = 1 MILE.

TABLE I. (Fig. 4).

Forty-five consecutive Wave-lengths.

′ ″	′ ″	″	′ ″	′ ″
16 10	12 0·75	8 1·75	19 2·5	13 9·75
12 7	19 0	14 2·5	19 11	21 3·75
16 2	13 9·5	14 7·75	14 6	18 11·5
22 1·5	20 8	16 2	17 1·5	22 1·75
11 7·5	17 3·5	19 10	22 5·5	21 6·25
20 7	20 8	16 9·5	12 8·5	23 2·5
20 6	14 1·5	16 10	14 10	11 2·5
21 3·5	19 2·5	14 11·5	17 9·5	16 11·75
15 1·5	13 4·5	20 1·5	18 0·25	29 2
average L., 17′ 5″·11	average L., 16′ 8″·25	average L., 15′ 8″ 94	average L., 17′ 4″·75	average L., 19′ 9″·75
average difference between succeeding L.'s = 28·9 per cent. of average L.	av. diff., etc., = 32·4 per cent.	av. diff., etc., = 17 3 per cent.	av. diff., etc., = 20 9 per cent	av. diff., etc., = 28 6 per cent

the ridges, proceeding up stream towards the centre of the shoal until the ridges became irregular. The ridges are nearly parallel with those on the other

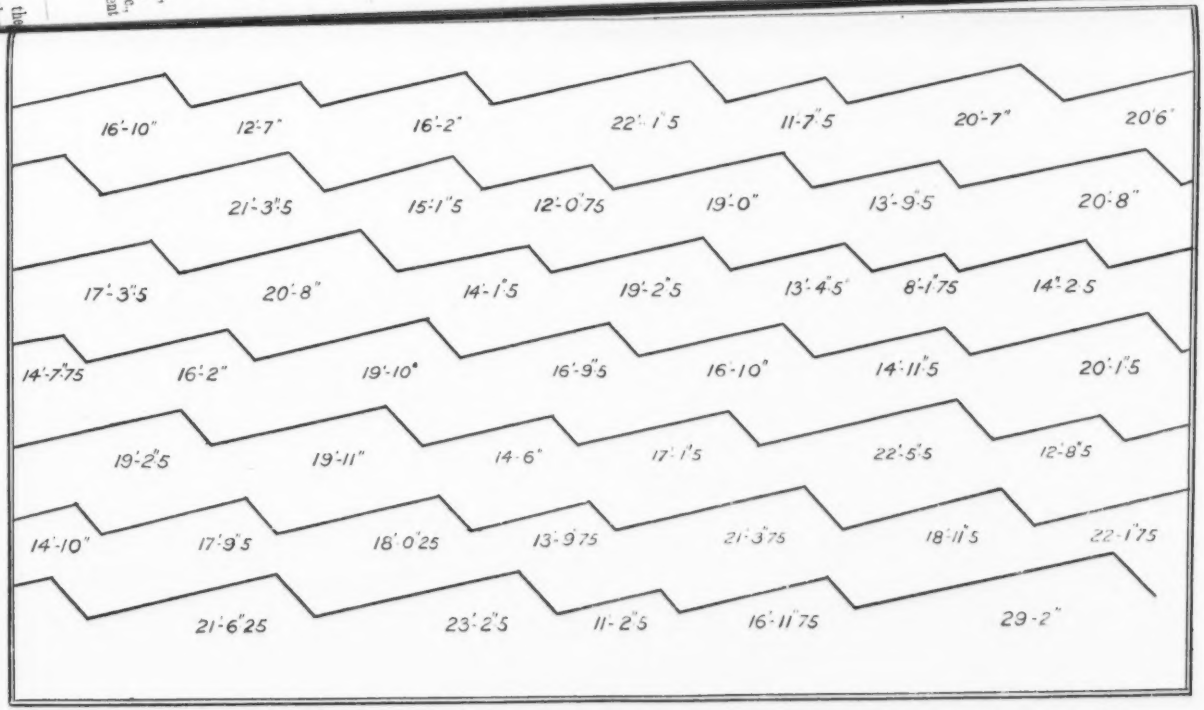

FIG. 4.—MAWDACH ESTUARY, FORTY-FIVE CONSECUTIVE WAVE-LENGTHS. AMPLITUDES NOT MEASURED, BUT DRAWN SO THAT L = 6 H.
HORIZONTAL SCALE, 1" = 16'.

sandbank, and must be caused by a motion of water almost at right angles to that in the main low-water channel between the sandbanks.

TABLE II. (Fig. 5).

Twenty-one consecutive Wave-lengths.

′ ″	′ ″	′ ″
20 8	18 1·5	10 5·25
23 11·75	13 10·5	17 0
20 10·75	15 8·25	11 7·25
13 2·5	13 8	10 7·5
20 3·25	17 5·0	13 10·5
13 1·5	11 5·75	13 1
17 11	12 5·75	14 8·25
average L., 18′ 6″·96	average L., 15′ 2″·96	average L., 13′ 0″·54
average difference between succeeding L's = 20·7 per cent. of average L.	av. diff., etc., = 20·5 per cent.	av. diff., etc., = 23 per cent.

That such figures for a single section are not inconsistent with an appearance as of fairly regular waves is shown by the photographs and by the diagrams. It is instructive to compare these average percentage differences between successive wave-lengths with the corresponding figures for analogous structures. On p. 23, *Geogr. Journal*, Jan. 1900, are the measurements of a series of small dunes produced by wind in the fine loose sand of the dry Nile bed. Their average wave-length is 30′ 5″·75, and the average difference between successive wave-lengths (along one section) is 33·2 per cent. of the mean wave-length, which is greater than in the above examples of tidal sand-ridges. Nevertheless, the photograph of these small dunes, Fig. 21, Plate I., *Geogr. Journal*, Jan. 1900, shows that they present the appearance of a regular train of waves. This appearance probably depends more on the parallelism of the ridges than upon the equality of their wave-lengths, especially when the eye elevation is small. On p. 27, *loc. cit.*, are the measurements of a series of large ripples formed by wind in the sand to leeward of a dune at Ismailia. The wind here had begun to get down to the compacted lower layers of sand, and the ripples had no longer the appearance of almost perfect regularity which often characterizes them where the sand is quite loose as well as dry. The average difference between successive wave-lengths is 42·5 per cent. of the mean wave-length.

Sand-ripples formed by water-waves and left dry by the receding tide are often more regular than the tidal sand-ridges above low-water mark. Thus, on January 8, 1900, at Barmouth, I measured a series of the ripple-mark formed by the waves on the higher sandbanks near the southern shore of the Barmouth estuary in the backwater above the railway embankment, at a spot somewhat to the right of the middle of Fig. 1 (Plate I.), and less than one-third from the top. The swell was here regularized by the regular and very gentle slope of the shore. The measurements commence at the deeper end and proceed shoreward. The ridges are contour-lines on the slope.

FIGS. 5 AND 6.—MAWDACH ESTUARY. HORIZONTAL SCALE, 1" = 16'. AMPLITUDES NOT MEASURED, BUT DRAWN SO THAT L = 6H.

TABLE III.

Ripple-mark, Mawdach Estuary, in Backwater above the Railway Embankment.

Eighty-six consecutive Wave-lengths.

Wave-length (L).	Amplitude (H), approx.	L. contd.	H. contd.	L. contd.	H. contd.	L. contd.	H. contd.	L. contd.	H. contd.
cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.
5·5	1·0	4·4	0·9	5·4	0·95	4·30	0·95	5·4	1·0
5·1	1·0	5·4	1·0	5·3	1·0	4·15	0·75	4·0	0·6
6·1	1·0	5·1	1·1	4·0	0·6	4·1	0·7	2·8	0·6
5·1	1·0	5·2	0·95	4·35	0·7	4·8	0·75	5·9	0·9
5·5	0·9	5·0	1·0	5·5	0·95	6·3	0·9	5·6	1·0
6·0	1·1	5·7	1·25	5·2	1·05	4·9	0·85	5·6	0·8
5·6	0·95	5·85	0·9	5·4	1·1	4·1	0·8	5·1	0·9
5·5	1·0	5·80	1·0	4·8	0·9	4·1	0·9	4·3	0·5
5·0	1·0	5·25	0·8	4·85	0·75	5·4	0·95	3·25	0·5
4·9	0·95	5·15	0·9	4·5	0·8	5·5	1·05	5·1	0·9
5·3	1·1	5·10	0·9	6·1	0·9	5·4	1·1	4·8	0·95
5·4	0·95	5·7	1·05	4·9	0·9	4·95	0·85	5·55	1·15
5·0	0·95	5·2	1·05	3·8	0·9	4·5	0·9	5·6	1·0
5·1	1·0	4·75	0·9	4·1	0·8	5·2	0·9	4·5	0·65
5·1	1·0	4·9	0·75	4·5	1·05	4·9	0·85		
5·5	1·1	4·0	0·8	5·2	0·8	5·0	0·75		
5·6	1·05	5·45	1·0	5·4	1·0	4·8	0·9		
5·0	0·9	5·55	0·95	4·85	1·0	5·35	0·9		

Average L, 5·05 cm.; average H (approx.), 0·913 cm.; $\frac{\text{average L}}{\text{average H}} = 5{\cdot}53$;

average difference between each L and that next succeeding = 10·9 per cent. of average L.

The measurements give the average wave-length with accuracy, but, owing to these ripple-marks not having a sharp crest, the difference between consecutive wave-lengths probably appears greater in the measurements than it was in reality. The wave-length diminishes very slowly as we proceed shorewards; the amplitude (H) diminishes somewhat more rapidly. The average wave-length is about 5·53 times the average amplitude, this number increasing slightly as we near the shore, as does also the irregularity of wave-length. The next succeeding 110 consecutive wave-lengths averaged 4·98 cm. The decrease from 5·05 cm. to 4·98 cm. may be considered as spread over $\frac{86 + 110}{2}$ wave-lengths, giving a decrease of 0·014 per cent. per wave-length. [5·08 cm. = 2″.]

The measurement of the tidal sand-ridges was continued on January 11, on the bank below the railway bridge near the ridges shown in Fig. 2. They are approximately in prolongation of the line of the measurements above bridge, and extend nearly to the bridge. The ridges faced up stream; they were the nearest to the deep channel of those uncovered during the neap tide. The greatest amplitude measured was 2′ 2″. The measurements, as before, commence at the seaward end.

TABLE IV. (Fig. 6).

Eleven consecutive Wave-lengths.

′	″		′	″
31	7		21	7·5
21	2		34	2
25	4		32	4
27	3		20	8
27	10		28	11
25	7·5	average L =	26	10·55

Average difference between successive L's = 21·1 per cent. of average L.

Although these large ridges faced with the flood, the little "current-mark" ripples under water faced with the ebb, showing that the last of the ebb is in the opposite direction to that in which the tidal sand-ridges face, but has not been able to reverse them.

On January 16 (spring tide) the tidal sand-ridges were seen on each side of the narrow low-water channel between the island Ynys y Brawd, and the town of Barmouth. On the town side these ridges were facing with the flood, on the island side with the ebb.

On January 17 the first "low" (or channel-like depression) on the foreshore opposite the north end of the Marine Parade was seen to be in ridges of about 9′ wave-length, obviously the same in all essentials as the tidal sand-ridges on the sandbanks of the estuary, which are out of reach of the heavy waves. They face parallel to the shore, and not in the direction in which the surf beats, which shows that they are essentially tide-formed, not wave-formed. The waves, however, must have some influence, and what this is will to some extent appear from observations in other localities recorded in this paper.

On the 17th, also, the "lows" on the sandspit beyond Ynys y Brawd, on either side of a perch, or beacon, were all in fine ridges with an estimated amplitude of 1′ 6″. Six days before, at the time of smallest tides, these lows were smooth, which shows that it does not take many tides to create ridges of the largest size.

Observations at Grange-over-Sands (Morecambe Bay, Lancs.).

January 21 to February 4, 1900.

The sands here are almost flat from the shore to the river channel, which has steep sides, and suffices to contain the river for the greater portion of the day. The spring tide comes up the channel as a small bore, followed by a very rapid current, which soon fills the channel to the brim. The waters then spread gently over the extensive flats of somewhat tenacious, clayey, sands. No sooner do the waters reach the shore than they begin to recede again, and are soon confined to the main channel and the tributary brooks. During fairly calm weather, such as we had during my visit, the sandflats show no tidal sand-ridges, although often covered with ripple-mark of various and beautiful patterns, which I cannot deal with in this paper. They show perfect interpenetration of the sand-ridges, simultaneously formed by crossing water-waves. This character of interpenetration is not exhibited to anything like the same extent by the tidal sand-ridges, although it is not entirely absent, as will be seen, *e.g.*, by referring forward to Fig. 18 (Plate I.).

Observations at Findhorn, N.B.

February 26 to March 1, 1900.

During the visit to Findhorn the tides were increasing, the smallest (neap) tide having occurred on February 14, and the greatest (spring) tide being due on March 3. As at Barmouth, so here, there is an extensive tidal basin, which has to empty itself by a narrow channel, through which the tide runs with considerable violence (Fig. 7).

The point of the central shoal is in tidal sand-ridges of about the same wave-length as those at Barmouth. They were only uncovered at a low stage of tide. The parts of the shoal further from the sea are uncovered at an earlier stage. Ridges were also noticed on the west side of the channel opposite the village, and others less permanent in character were seen on the sandspit, dry at low water, which prolongs the promontory on which Findhorn is situated. On this sandspit,

which is exposed both to currents and waves, I noticed on the 26th isolated pools of water left by the partial obliteration of the sand-ridges. Their cross-section is that of fuljes,* to which they are obviously analogous, a point to which I return later (see p. 182). On the 27th, with a rough sea, the pools were all that was left in other places where, on the 26th, with calm sea, there had been regular ridge and furrow. The shortest tidal-sand-ridges had a wave-length of 3′ 6″, the average of thirty-

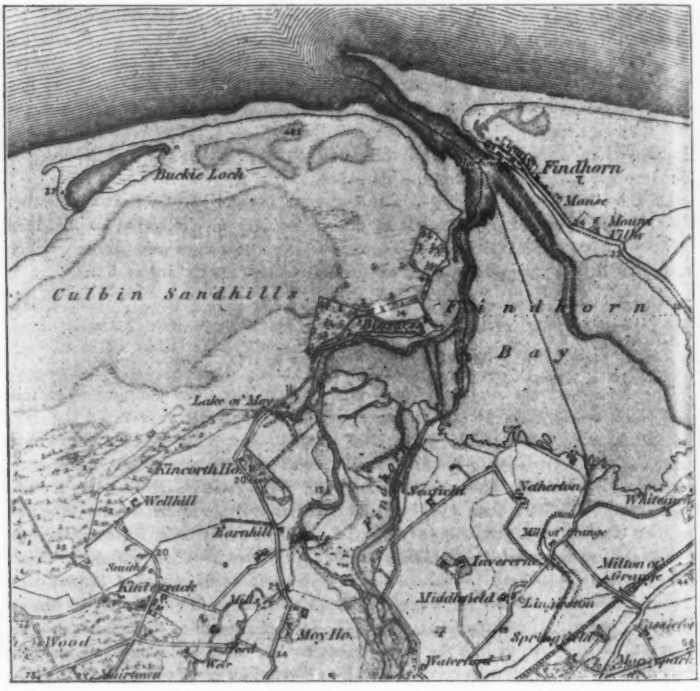

FIG. 7.—FINDHORN BAY. SCALE, 1″ = 1 MILE.

seven consecutive waves. They faced north-north-west, *i.e.* with the ebbing tide. The wind was north-north-east.

Observations at Montrose, N.B.

March 3—17, 1900.

At Montrose, again, there is a broad tidal basin filled and emptied through a narrow channel, which circumstance induced me to visit the place in search of

* See the author, "On the Formation of Sand-dunes," *Geographical Journal*, March, 1897; and "On Desert Sand-dunes bordering the Nile Delta," *Geographical Journal*, January, 1900.

tidal sand-ridges. The tidal conditions are well described in the *North Sea Pilot*, Part ii., 5th edit., 1895, as follows:—

"The great difficulty in Montrose harbour is the strength of the stream, which at times runs at the rate of 6 miles per hour. The time of slackest water in the channel is from just before low water to quarter flood, or perhaps a little later, when the slake is fairly empty. The young flood then setting in, having only to fill the channels in the mud of the slake, is moderate in force. Directly, however, the level of the water

FIG. 8.—MONTROSE BASIN. SCALE, 1″ = 1 MILE.

rises to the general height of the mud in the slake, the stream rushes in with furious velocity. There is little or no slack in the stream at high water, and the ebb runs out with strength to low water. . . . After passing the inner lighthouse the strength of the flood is confined to the south shore, and that of the ebb to the north shore of the harbour. The first of the ebb sets across the Annat sand" (Fig. 8).

Mussels are largely cultivated on the sandbanks of the slake, or tidal basin, to a great extent fixing them, but on the north side of the main channel the sands are being added to by the formation of a new bank on the inner side of the curved low-water channel. This bank is composed of clean sand and shells, free from mussels or weed, and presents a striking appearance from the regularity and large size of the ridges with which it is completely covered. They all face eastward, *i.e.* with

the ebb. The shoal itself rises very gently from the west, and terminates in a steep slope at the swatch-way on the east. Thus there is conformity between the longitudinal section of the ridges and a parallel section through the shoal itself. The ridges are all practically parallel, and they do not face in conformity with the curve of the low-water channel (which is that of the convex low-water margin of the shoal on its southern side), the direction of their facing indicating a bottom current forced towards the centre of the curve, as described by the late Professor James Thomson in his paper upon the "Winding of Rivers in Alluvial Plains."

On this bank, near the main channel, I measured on March 6 a series of ridges (Table V.), of which the first and last are at low-water mark, and north-westerly of this I measured another section (Table VI.), which was found to be almost exactly parallel with the former, and of which the last ridge was about 200 feet north of the first ridge of series V., and almost in continuation of it. The series VI. has a lesser depth of water over it than series V., and is further from the main channel. The last ridge of VI. is not far from the swatch-way dividing this sand-bank from the mussel-bank. The measurements go down-stream, in the direction towards which the ridges face.

TABLE V. (Fig. 9).

Wave-length (L).	Amplitude (H), approx.
′ ″	′ ″
27 0	1 4
24 11	1 4
13 7	1 0·5
17 10	1 1
13 1	0 11
14 10	1 1
18 11	1 3
15 3	1 2·5
18 11	0 9·5
25 11	1 5
av. L = 19′ 0″·3	av. H = 1′ 1″·75 (approx.)

$\frac{\text{av. L}}{\text{av. H}} = 16{\cdot}6$ (approx.)

av. difference between succeeding L's = 24·9 per cent. of av. L.

TABLE VI. (Fig. 10).

Wave-length (L).	Amplitude (H), approx.
′ ″	′ ″
18 8	1 1
17 10	1 1
12 0	0 11
14 9	0 10·5
14 8	1 1
11 0	1 0
14 3	0 10
12 0	0 10·5
12 3	0 11·5
12 1	1 1·5
18 6	1 6
15 11	0 9·5
10 11	0 10
13 2	0 8
19 0	1 2
av. L = 13′ 2″·4	av. H = 11″·83 (approx.)

$\frac{\text{av. L}}{\text{av. H}} = 13{\cdot}39$ (approx.)

av. difference between succeeding L's = 22·3 per cent. of av. L.

The first and last ridge of the V. series were marked by stakes. On the following day, March 7, the first ridge of the series had moved forward (*i.e.* to the east, in the direction in which the ridges faced) 30″·5, and the last ridge of the series had moved forward 31″. Of the VI. series one ridge marked by a stake had in the same time moved 24″ to the east. On the next following day, March 8, three stake-marked ridges of the VI. series had moved 25″, 25″·5, and 27″·5 respectively. During the three days March 6—8 inclusive, with a diminishing range of tide, the average amplitude of the ridges of V. series decreased appreciably, but the wave-length remained practically constant.

On March 12, with a strong westerly gale blowing, the ridges were much more sinuous, and many pools of water remained at low tide owing to dams across the

FIGS. 9 AND 10.—MONTROSE BASIN. HORIZONTAL SCALE, 1" = 16'. VERTICAL SCALE = 3 × HORIZONTAL.

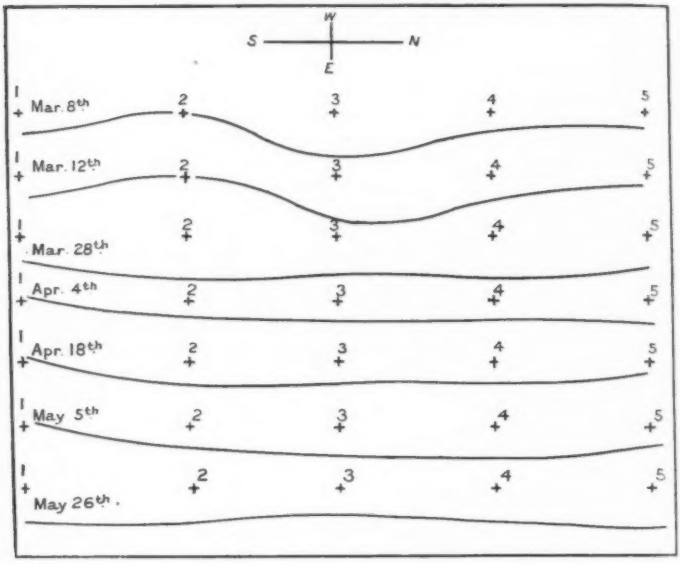

FIG. 11.—MONTROSE BASIN. POSITION OF WAVE-FRONTS, MARCH 8—MAY 26. SCALE, 1″ = 32′.

troughs where sand had been washed in from the ridges. Fig. 11 is a plan of the wave-front nearest to the cross-row of stakes, which I put to connect the beginning of series V. (south) and the end of series VI. (north). The measurements were continued for me after March 12 by Captain John Inglis of Montrose. No record was kept of the number of ridges which passed the line. The diagram shows the constancy of the orientation of the ridges nearest the cross row of stakes during an interval of eleven weeks.

On March 7 I examined the bank to the north of the rippled shoal. A great part of it is covered with mussels or with weed. The surface is very uneven, and the vertical inequality is about the same as on the rippled shoal, without, however, any regularity of form or arrangement.

On March 13, on the foreshore north of the harbour entrance, I noticed tidal sand-ridges in a "low" along which the tide was ebbing strongly. From the conformation of the sands it seemed unlikely that the flood tide could run strongly up this low in the opposite direction, and it seemed probable, therefore, that these ridges were being formed without the co-operation of a return current.

On March 17, spring tide and a good deal of wind, the receding tide partially obliterated the tidal sand-ridges on the foreshore, leaving pools analogous to fuljes, of which Fig. 12 shows characteristic examples. Those shown in the photograph are about 15 feet from right to left. The steep face is on the right. The chain of four pools has been formed in a single long trough to the left of the former ridge. This supports my idea that in the deserts a lateral (as well as the longitudinal) connection may be traced between neighbouring fuljes (see Plate I.).

Observations at Mundsley, Norfolk.

April 14–17, 1900.

I decided to visit the north coast of Norfolk in order to see the effect of the sea in producing tidal sand-ridges where there is no neighbouring estuary or tidal river, and where, owing to the general trend of the coast-line, the tidal currents may be expected to be strong and to run parallel with the shore. I selected Mundsley, east of Cromer, on the suggestion of Mr. Clement Reid, F.R.S. On April 15 and morning of 16th, with the wind off shore, the sands exposed at low tide were mostly smooth, only in the low between the beach and the "ball" were there well-preserved tidal sand-ridges. The wave-length (L) was 4′ 10″, average of thirteen consecutive waves, and the ratio $\frac{L}{H}$ was approximately 16·7. The crests of these ridges were at right angles to the shore, whereas if they were wave-formed they would be nearly parallel to the shore. Probably, however, wave-disturbance under suitable conditions induces the formation of tidal sand-ridges in places where the tides alone would not be strong enough, for the jerk of the waves throws sand into suspension.

On the "ball" the much-blurred traces of tidal sand-ridges were measured on the morning of April 16, and had a wave-length of about 4′. In the afternoon of the same day the wind changed, and blew along shore from the direction of Cromer with moderate force, and breakers apparently 3 to 4 feet high came in at high tide. In the morning of April 17 the ball was all in conspicuous but irregular tidal sand-ridges facing eastwards (Fig. 13).

The average wave-length of six ridges on the ball was about 19 feet, but appearances suggested that some of the smaller ridges had been obliterated.

Fig. 13.—The "ball" at Mundsley, Norfolk.

FIG. 14.—A "LOW" AT MUNDSLEY, NORFOLK.

In the low the average wave-length of nine consecutive ripples was about 11′ 6″ (Fig. 14). There has been no increase in the calculated tides since the 15th, and the greatly increased dimensions of the ripples must therefore be attributed to the action of the wind upon the water.

Observations on the Severn Shoals, April 26 to April 30, 1900.

The first place selected for observations was Severn Bridge, a little above Sharpness, the entrance to the Berkeley and Gloucester canal. Above this the river has a steep gradient to beyond Newnham, and is much encumbered by sand-banks. Ordinary spring tides at Sharpness rise 27 feet, and neaps 15 feet.* The general character of the spring tides between Severn Bridge and Newnham is as follows. The flood commences with almost absolute suddenness, as a violent rush of water, which however, at Severn Bridge itself, does not usually assume the form of a bore. The whole rise of level is accomplished in a remarkably short time; the current, however, does not turn when subsidence begins, but continues to flow up stream gently and quietly. When the seaward current commences, therefore, the water is no longer deep over the sandbanks. Just above Severn Bridge is a broad sandbank marked "Waveridge sand" on the Ordnance Survey Map, but locally known as "Waifridge." During my visit this sand was practically smooth (though showing current-mark), except at the tip near the bridge, where there were some tidal sand-ridges facing with the ebb. There is comparatively quiet water here before they are uncovered. The sandbanks between here and Newnham are all (as far as I have seen them) similar in character.

The main channel of the ebb is close to the western shore, from which the

* 'Sailing Directions for the West Coast of England.' 4th edit., 1891.

currents can be readily observed. The rush of the flood over the "Waifridge" is best seen from the commanding elevation of the bridge, 100 feet above low-water mark. I watched this on April 27, two days before the highest of this set of spring tides. The rush of water under the bridge is terrific. I was told by the custodian of the bridge that 10 knots has been actually measured there, and that at exceptional spring tides the speed must be greater. The flood does not force its way up the main low-water channel, but swings out to the east, works up a swatchway on that side of the point of the "Waifridge," and subsequently sets strongly across the sands towards the main channel and the western shore. As the water rushed over the sands, the spurting of the imprisoned air presented quite a remarkable appearance. Such a rush of water over nearly dry sands is incompatible with the formation or preservation of large ridges. The sand would slide in bulk from crest to trough.

On the following morning (April 28) at 8.45 a.m. the tide was ebbing gently and quietly over the Waifridge, but at 9.15 a.m. was rushing over it in waves and with the sound of surf. This, and perhaps the existence of cross-currents, explains why the ebb does not leave the sands in ridges. Leaving Severn Bridge by boat at 10 a.m., I dropped down with the tide past many sandbanks, which, as far as could be seen from the boat, were mostly smooth, until I reached at 12.10 p.m. the Dun Sands below the junction of the Wye and Severn (Fig. 15). I had been

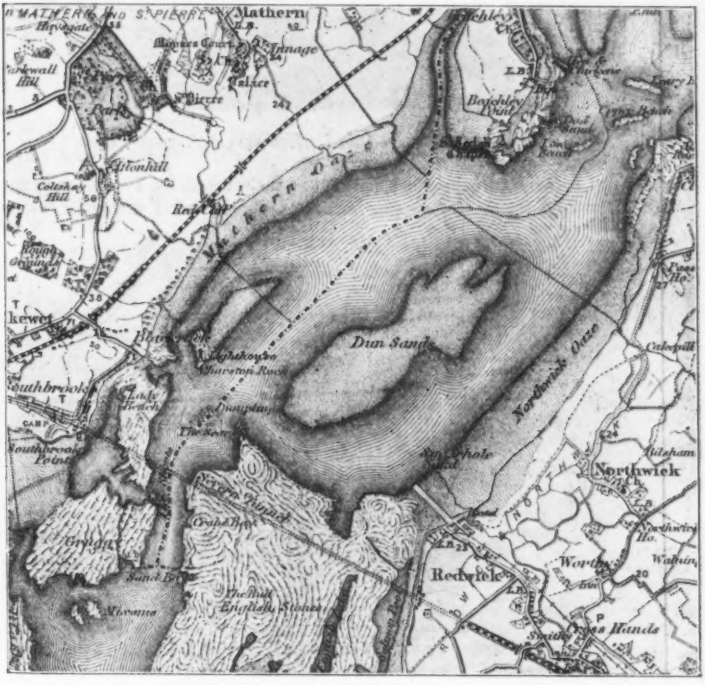

FIG. 15.—THE DUN SANDS. SCALE, 1″ = 1 MILE.

informed at Severn Bridge that this shoal, unlike most of the other sandbanks, was normally in ridges. I found it to be so on this occasion, and was struck by the

FIG. 16.—RIDGES ON THE DUN SANDS, RIVER SEVERN, LOOKING EAST.

total contrast between its appearance and that of the other shoals I had seen in the Severn. Fig. 16 is a view looking east from the highest point of the sands, which

TABLE VII. (Fig. 17).

Fifteen consecutive Waves.

Wave-length.	Approximate amplitude.
′ ″	′ ″
38 11	2 0·5
54 0	1 4
38 0	1 6·5
45 7	2 0 75
46 7	1 11
29 7	1 8
37 5·5	1 2
52 0	2 9
32 10	2 6·5
44 8	1 7·5
36 0	1 9
35 2	1 2·5
22 4·5	2 9·5
23 0	1 2·5
29 5·5	2 1
average L = 37′ 8″·5	average H = 1′ 11″·22

Average difference of succeeding L's = 26·4 per cent. of the average L.

$$\frac{\text{average L}}{\text{average H}} = 19{\cdot}49 \text{ (approx.)}$$

FIG. 17.—DUN SANDS, RIVER SEVERN. HORIZONTAL SCALE, 1" = 16'. VERTICAL SCALE = 3 × HORIZONTAL.

is south-west of the narrow portion, and not far from the western side. The man's figure is distant about 25 yards from the camera. The preceding measurements give the dimensions of the largest ridges, proceeding from east to west (approximately), the ridges facing this way towards "the Shoots," or narrow low-water channel between two rocky shoals which are shown on the map. There is a gradual rise of level as we proceed along this group of ridges, terminating in a steep slope down nearly to low-water mark, the gentle slope and steep slope of the shoal corresponding with those of the ripples, as noted at Montrose.

These ridges had undulating crests and somewhat sinuous wave-fronts. Many pools are formed in the troughs, and in these, my boatman told me, salmon are often impounded between tides. The photograph (Fig. 18, Plate I.) was taken at the narrow portion of the shoal where the sands are lower than those to the north-east or to the south-west. Here, my boatman informed me, the ebbing tide runs across the shoal after the south-west portion uncovers. Evidence of this cross-current is given by the existence of two sets of tidal sand-ridges interpenetrating nearly at right angles, as shown on the photograph. A ridge of one set starts near the right-hand bottom corner, and can be traced to a point more than halfway up and more than halfway across the picture, a distance which comprises four wave-lengths of the second set of ridges, which face the camera. This wave-characteristic of interpenetration is not often seen in tidal sand-ridges, whereas it is common in the wave-formed ripple-mark of the strand. The water began to rise at the sands about 2 p.m. I crossed to Beachley Point and watched the rise of the tide from there. The Dun Sands were covered about 3.45 p.m. The rocky shoal "English Stones" lower down the river, which projects as a groyne from the south-eastern shore, was still uncovered at 4.10 p.m., but was invisible at 4.50 p.m. This rocky groyne, which reaches nearer high-water mark than the Dun Sands, must cause the water both to cover and to leave them gently, without preventing a strong current, at all events on the ebb, when the water is deep over the sands, and I infer that it is by this combination of circumstances the tidal sand-ridges are made and maintained. The existence of a shoal in the position of the Dun Sands, and the shape of the shoal, must also be due primarily to this ledge of rock. The circumstances are analogous to those of a model estuary with a large groyne described by Professor Osborne Reynolds (pp. 16–17, Report of Committee 'On the Action of Waves and Currents, etc.,' British Association, 1891). In these experiments the groyne projected from the right instead of the left bank as do the English Stones. In order to avoid confusion, I have ventured to alter "right" to "left," when the following account of what occurred in the experiments with the model estuary may be taken as a general description of the course of affairs at the Dun Sands:—

". . . It was the large eddy caused by the groin which caused the greatest effect. The water entering on the right of the estuary crossed over to the left, and returned along the left bank. In other words, during flood the left side of the estuary . . . was in back-water. This back-water also gave the ebb a start down the left bank, which rendered the ebb stronger on this side. The sand came down rapidly on the left side, and, besides, was carried over from the right to the left, and formed a bank along the left middle of the estuary. . . . Round this bank the water circulated, carrying the sand with it up on the right and down on the left."

During the full strength of the flood, the same author states, projections of the banks only cause a retardation of the rate, not a reversal of the direction, of the current, in the area of that which one terms the eddy.

On April 29 I was at Newnham-on-Severn, where the extensive sands are mostly smooth. There were, however, a few tidal sand-ridges of no great regularity above the landing-stage in a position where there is an eddy on the ebb, and which is

also protected from the violence of the first of the flood. In the evening I watched the bore discharge an oblique breaker over the sands of the eastern shore, and this was immediately followed by a current of great speed, slackening later on when the depth is greater. It continues to run up, as has been already stated, while the level of the water is falling. The conditions here are the opposite of those at the Dun Sands, but similar to those just above Severn Bridge.

Observations on the Goodwin Sands.

May 12, 1900.

On May 12, in fine weather, with a light north-easterly breeze, I landed on the North Goodwin, near the north-west buoy, at 4.20 p.m. The date was half-way between those of neap (May 8) and spring tides (May 16), but the height of tide approached more nearly to that of the springs. The winds of late had been variable and mostly light. The following is the wind-record from May 1 to 12 posted at Ramsgate by the harbour-master, the force being indicated by the numbers 0–12: 1st, W., 2; 2nd, S., 2; 3rd, S.W., 6; 4th, S.W., 5; 5th, S., 3; 6th, E.N.E., 2; 7th, S.W., 2; 8th, N. by E., 3; 9th, W., 3; 10th, N. by W., 3; 11th, E. by N., 3; 12th, N.E., 2. The tidal current in the Gull Stream, *i.e.* along the western shore of the North Goodwin, runs north-east from about two and a half hours before high water at Ramsgate for about seven hours, *i.e.* until four and a half hours after high water, and then turns and runs in the contrary direction for about five hours, these streams having an average rate of three knots at springs and two knots at neaps.*

At the time of my visit to the Goodwins, these currents can have been very little influenced by the winds, but such wind as there was caused the waves to traverse the sands in the opposite direction to the north-east stream. I found most parts of the sands to be in ridges, except the sloping shore exposed to breakers on the north-west and north-east. In exposed positions the tidal sand-ridges were a good deal blurred and rounded, and in some cases only pools remained below the general level of a smoothed surface. In positions open to the south-west, but sheltered from the north-east by the higher portions of the bank, the ridges were better preserved (Fig. 19, Plate I.). The photograph is taken looking south: the tidal sand-ridges face the camera; the current mark, showing the direction of the current just before the sands were uncovered, faces in a south-and-east direction. Bordering on a shallow bay, sheltered from the north-east, but open to the south-west, I saw two orders of tidal sand-ridges facing the same way (viz. northerly), major ridges (of which three in succession measured 66′, 88′, and 64′ 6″ in wave-length, with amplitudes of approximately 22″) and smaller ridges on their weather slopes of about 15′ wave-length, which was the ordinary size of the tidal sand-ridges. The colour of the larger ridges was, I think, of a different tone from that of the smaller. Further observations on similar ridges were made subsequently (see p. 193). In the time at my disposal, I covered about a mile of the sands, and found that everywhere the tidal sand-ridges faced in a northerly direction, *i.e.* against the light wind and against the waves, which are not insignificant on the Goodwins even when the wind is light. It is evident, therefore, that these ridges are due to the tidal current, and not to waves —a point about which I wished to be certain, because the sand-ridges on the Goodwins have been cited by more than one author as an example of the supposed maximum dimension of wave-formed ripple-mark. These citations originate from the following passage in a little work on lifeboat-work on the Goodwins†:—

* *Vide* King's 'Pilots' Handbook for the English Channel,' 12th edit., p. 143.

† 'Storm Warriors,' by the Rev. John Gilmore, M.A., pp. 108, 109.

"On the Goodwins, where the force of the sea is in every way multiplied, and the waves break and the tide rushes with tenfold power, the little sand-ripples of the smoother shore become ridges of two or three feet high. It is on these ridges that the lifeboat so continually grounds."

I infer from my observations that it is the ridges facing with the current, not the wave-formed ripple-mark, which have a reputed height of 2 or 3 feet.

We have next to consider why the exposed tidal sand-ridges at the time of my visit were facing with the flowing tide and not with the succeeding ebb, though the wind favoured the latter. Observation from Ramsgate on May 11, 12, and 13, showed that the higher (north-east) portions of the north Goodwin were covered and uncovered about $3\frac{1}{2}$ hours before and after high water. As the south-west-going current (unless influenced by wind) does not commence until $4\frac{1}{2}$ hours after high water, it follows that during this current the sands are partly bare, and that those which are under water are sheltered by the uncovered part on the north-east, and are presumably in a back-water or "eddy tide." The whole of the sands, on the contrary (except the short and comparatively steep slope on the north-east of the summit), are fully exposed to the north-east-going flood current, and therefore face this way. Here, again, the gentle and steep faces of the tidal sand-ridges correspond with the gentle and steep slopes of the shoal itself. Probably a strong northerly wind would reverse the ridges for a time.

Observations in Pegwell Bay.

May 14, 1900.

On May 13, the wind blew with a force 4 of the scale 0–12 from north-east by east, increasing in the night, and on the morning of the 14th, to force 6 from east-north-east. In the afternoon I visited Pegwell Bay. There had been a strong current setting into the bay in the morning, and the flats of sticky sand, exposed at low water, were covered with tidal sand-ridges of about 8′ wave-length and 3″ amplitude. These, however, were so irregular that they might not be recognized for what they are by an unaccustomed eye. In calm weather, I am informed, these sands are smooth except for the ordinary small ripple-mark. This observation shows that the "tidal" sand-ridges can be formed by a drift of water caused by the wind setting into a bay.

Observations in the Dovey Estuary, North Wales.

May 31 to June 20, 1900.

The deep tidal channel of the river Dovey now clings for the most part to the northern shore of the wide valley, a long spit of sand and shingle having grown out from the southern side. On the south-west is the longest stretch of open sea, where the wind has most power over the water both in respect of creating waves and causing currents* (Fig. 20). As in the case of the Barmouth and Montrose estuaries, therefore, the spit of drifted materials has grown from the exposed side, and, under its shelter, the estuary has partly silted up. These estuaries may be called D-shaped. Down the straight stroke of the D runs the scouring ebb current; the silting current of the flood swings round the bow of the D. Prof. Osborne Reynolds has pointed out this effect of dissymmetry in the boundaries of an estuary. I now draw attention to the production of dissymmetry by littoral drift from the

* The author on "Sea Beaches," etc., *Geographical Journal*, May and June, 1898.

side exposed to the longest stretch of sea, and to the fact that the rivers have been pushed to their furthest possible limit, against hills of resistent rock.

The following is a general account of the distribution of the tidal sand-ridges above low-water mark in this estuary. From the high hills on the north shore they are spread out as a map, and they are, in fact, a most valuable map of the tidal currents. Generally speaking, the sandbanks have a very gentle slope and a fairly steep one, the latter usually on the outside of the curve of a low-water channel. On these steeper slopes the ridges face with the ebb, on the broader,

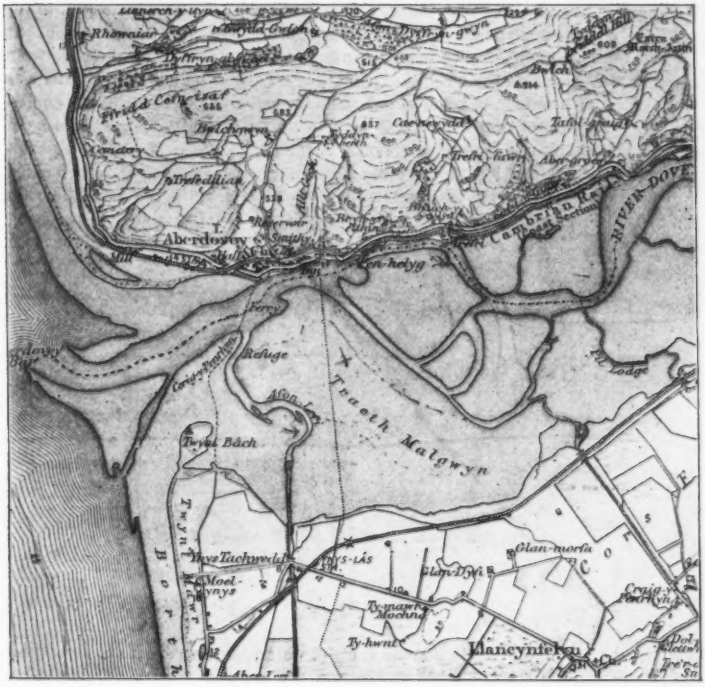

FIG. 20.—DOVEY ESTUARY. SCALE, 1" = 1 MILE.

flatter portions they face with the flood. The tendency of the flood current to take the shorter course across the banks, and of the strong ebb currents to follow a winding path, is very noticeable. The wave-fronts of the ebb-facing ridges are generally more sinuous than those of the flood; they suggest formation when the waters are running together as the banks dry out. The ebb-facing ridges seem also to be, as a rule, at a lower level than those which face with the flood. Symmetrical ridges with both faces sloping at about 12° are very rare above low-water mark; generally the slower reverse current appears to have no effect upon the *form* of the ridges as seen at low water, even in the case where, as I proved by observation from an anchored boat, the slower, in this case ebb, current followed the same path as the stronger, flood, current, in the reverse direction. It is to be noticed that the

ridges are larger than the size proper to the return current. There are, at least, two processes which might conceivably go on when a gentler current flows over, without reversing, or even turning, the top of the ridges: one is, cutting back the steep face; the other is, building it out. Both processes go in on snow-ripples,* but I cannot yet say if either occur in the case of the tidal sand-ridges.

The most interesting views of the sands are those from the wooded hill north-east of Trefri (above the last letter of that word on the map). Fig. 21 is from a photograph taken at an elevation of about 300 feet looking south-west by south (see Plate II.). The small rocky promontory of Trefri is on the right. Outside this promontory is a shoal with strong ridges facing with the flood (easterly, to the left); nearer is a small shoal with the ridges facing westerly with the ebb. It appears, from the configuration of the banks, that this small shoal, sheltered from the west, whence comes the flood, is exposed to a west-flowing ebb on the outer side of the bend of a minor channel shown in the photograph. The rocky promontory appears to deflect the flood so as to protect the ebb-made ridges from swift currents flowing in the reverse direction. Fig. 22 (see Plate II.) is from a photograph taken from the top of the same hill, at an altitude of 500 feet, looking south-south-west across the great semicircular shoal round which sweeps the main channel. The most marked feature is the regular series of straight ridges facing with the flood, which indicate that when the sandbank is submerged, the flood

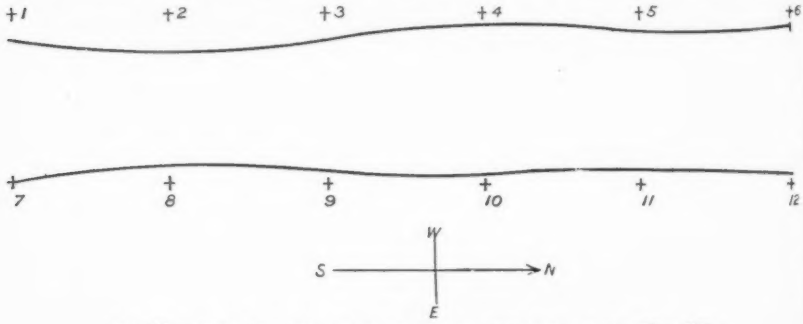

FIG. 23.—DOVEY ESTUARY. PLAN OF TWO WAVE-FRONTS. SCALE, 1″ = 32′.

flows swiftly and uniformly in a broad sheet of water, taking a short cut across the bend.

Fig. 23 is a plan of the wave-front of a part of two of these ridges exactly measured by means of stakes put in at distances of 30 feet in each row, with 22 feet between the rows. The ridges were well defined still further south, beyond the stakes.

The bend which the main channel now takes is greater than is shown upon the map. The increase of the shoal accompanying this retreat of the main channel does not appear to take place by the simple process of accretion on the convex shore near the apex, but, as well as I could judge, by the formation of crescentic outliers beyond the apex of the bend—banks conforming to the shape of the shoal, but separated from it by shallow channels, which are afterwards filled in, so that the outlier becomes part of the main shoal.

* "On Snow-ripples." Abstract of paper by the author read at Section E, British Association, 1900. See Report Bradford Meeting.

Fig. 21. Dovey Estuary, looking S.W. by S.

Fig. 22. Dovey Estuary, looking S.S.W.

Fig. 24. Ridges of Sand and Shells, Dovey Estuary.

Fig. 26. An "Experimental Plot," Dovey Estuary.

Observation of the Form of the Ridges where the Sand is mixed with Coarser Materials.

On one of the shoals the sand is mixed with stones and cockle-shells. Fig. 24 (see Plate II.) is a photograph of the ridges here. The leeward portions (right hand) consist of sand which has been picked out from among the coarser materials, held floating for a time in "eddying suspension," and finally deposited on the lee of the ridge. The weather side of the ridges, now faced with shingle and cockle-shells (left hand), assumes a slope almost as steep as the talus of the lee side, because the coarser material does not slide so readily as the finer sand would do under like conditions.

Observation of the Effect of a Supposed "Setting" of the Sand.

South-west of the experimental plot, among ridges facing with the flood, were some of considerable amplitude, which differed not only by their size, but

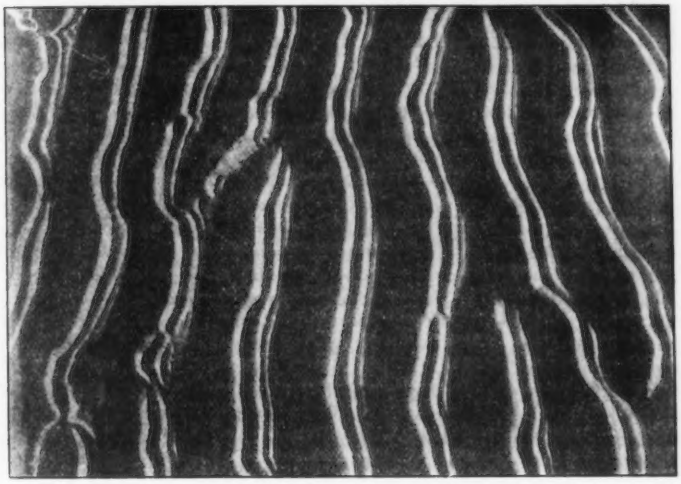

FIG. 25.—WAVE-FORMED RIPPLE-MARK WITH TRIPLE CRESTS, GRANGE, LANCS.

by the tone of colour, from the ordinary ridges. They reminded me of the larger order of ridges noticed on the Goodwins. I marked the crest and trough of one of these ridges by stakes. On June 4, after two days, I found that the ridge had not moved, although those on the experimental plot had travelled freely. I thought this might be due to lateral scour on the ebb, of which there was some evidence. On June 12 I noted that the big ridge had not moved, but a minor ridge in continuation of it had moved. I also have a note that the sands hereabouts are not so firm now as during the smaller tides. On June 15, when the tides were large, I took a photograph, which appears to show the building out of a new ridge under the shelter of the old one. This suggests that the stationary character noted on June 4 was due, not to the ebb undoing the work of the flow, but to actual immobility of the material of which the ridge is composed. On June 20, tides falling off, I have a note saying, "I think it is a case of building out in the shelter of the old ridge, 'a double crest,' in fact, as we get with (ordinary) ripple-

mark." On the whole, it seems that among the tidal sand-ridges which are exposed at low water, a *setting** of the sand sometimes occurs, and that this modifies the behaviour of the ridges in a marked manner. Probably the same occurrence accounts for the multiple crests sometimes seen in wave-formed ripple-mark (such as those of the preceding figure, Fig. 25). This example is from Grange, Lancs., where the sands, which are admixed with clay, are exposed to the air for many hours between tides, and have then sufficient coherence to yield a vertical section for measurement, and to admit of slices being removed on a spade for the purpose of being modelled in plaster. I propose to make further observations on the effect of *setting* upon the forms of ripple-mark and other sand-waves.

Measurements on an Experimental Plot.

On the sandbank Traeth Malgwyn, at a spot bearing south from the north end of Aberdovey pier, and north-east by east from the Refuge, I pegged out what I may term an experimental plot. Twenty stakes were driven firmly into the sand to a depth of about 3 feet. There were five transverse rows of stakes, 15 feet from row to row, and in each transverse row, parallel to the ridges, the distance from stake to stake was 20 feet. This gave a square plot of 60 feet side, permitting of the exact measurement of the position of five wave-fronts along four sections. Strings stretched from stake to stake at the two sides of the plot served as datum lines, and enabled amplitude to be taken with tolerable accuracy along two sections. The ridges here face south-westerly with the ebb. They are not parallel to contour-lines (as swell-formed ripple-mark of the strand usually is), but, on the contrary, are on a noticeable slope, so that the troughs act as channels for the last runnings of the ebb, which thus escape to the north, *i.e.* in a direction at right angles to that of the current which produces the ridges.

Fig. 26 (see Plate II.) is from a photograph taken on June 17, a view looking south, which includes the two first of the five cross-rows of stakes. At this date there had been several successive spring tides of ordinary height, and the ridges were well developed.

In the following table of measurements, I record for each day the depth of water on Old Dock Sill, Liverpool (from Jefferson's Isle of Man Almanac), for the tide previous to each observation. This shows the progress of tides from neaps to springs. The depths of water on the plot are not very far from one-half of these values.

An examination of this table shows, among other things, that, here, towards neap tides the ridges facing with ebb are smoothed out, and that the sands here remain almost featureless, but that, as the tides increase, well-defined steep ridges appear, which grow in height, and also, apparently by elimination of certain ridges, in average wave-length. As the tides fall off again the height or amplitude of the ridges rapidly decreases, the wave-length decreasing very slowly. Thus, from June 2 to June 5 the amplitude diminished 42 per cent., while the wave-length diminished only 2 per cent. During this diminution of amplitude there was no appreciable change in the general level of the sand surface. It will be noticed that the course of affairs during increasing and diminishing tides recalls what happens with waves at sea, where we have a short steep sea in a rising storm,

* Cp. Osborne Reynolds, 'Second Report of Committee on the Action of Waves and Currents, etc.,' p. 14, B.A. Report of Leeds Meeting, 1890; and G. H. Darwin, "On the Horizontal Thrust of a Mass of Sand," *Min. Proc. Inst. C.E.*, vol. lxxi. (1883), pp. 350–378

TABLE VIII.

Measurements of Experimental Plot, Dovey Estuary.

Date.	Depths on Old Dock Sill, Liverpool.	Wind.	Average amplitude (H).	Average wave-length (L).	$\frac{L}{H}$	Average daily advance of ridges.	Remarks.
June 1	17′ 5″ (a.m.)	easterly	—	14′ 3″·7	—	—	Depth, Liverpool, on May 29, 18′ 8″; May 30, 18′ 5″; May 31, 18′ 3″.
„ 2	16′ 3″ „	„	6″·34	13′ 10″·4	26·2	3′ 2″·1	Mean surface level, taking the ridge to be a rectilinear wedge, 4″·2 below the datum line.
„ 3	15′ 2″ „	„	5″·33	13′ 7″·25	30·6	2′ 5″·75	Mean surface level, 4″·3 below the datum line.
„ 4	14′ 2″ „	„ (fresh)	3″·94	13′ 6″	41·1	2′ 6″·6	Mean surface level, 3″·8 below the datum line.
„ 5	13′ 6″ „	„	3″·71	13′ 6″·6	43·8	0′ 1″·4	Mean surface level, 3″·91, *i.e.* no perceptible change since June 1. The advance of ridges had almost ceased, quite suddenly, as if the tide current had fallen below a critical velocity.
„ 6	12′ 10″ „	south-westerly	—	13′ 5″·8	—	2″·9 (one tide)	
„ 7	12′ 10″ „	south-westerly (fresh)	—	13′ 4″·6 (approx.)	—	—	The lee cliff has vanished; measurements for length therefore difficult. The troughs show ripple-mark due to wind-raised waves perpendicular to the ridges, and there is "current mark" facing with the flood.
„ 8	13′ 1″ „	westerly (fresh)	—	—	—	—	The old ridges still visible as gentle swells, but crossed diagonally by a "swell" from south-west, which is more conspicuous.
„ 9	13′ 8″ „	—	—	—	—	—	No observations of the plot to-day (9th).
„ 10	14′ 4″ „	—	—	—	—	—	Did not land on plot to-day; as seen with field-glass from shore, ridges still irregular and ill-defined.
„ 11	15′ 5″ „	calm	—	—	—	—	No observations of the plot to-day.
„ 12	16′ 1″ „	westerly (light)	estd. 6″ at max.	estd. 7′ 6″ to 8′ 6″	—	—	Plot all in sharp ridges from same quarter as at beginning of the month, but seven to eight wave-lengths in the 60 feet, instead of four.
„ 13	16′ 9″ „	—	—	—	—	—	No observations.
„ 14	17′ 7″ (p.m.)	—	—	—	—	—	Ditto.
„ 15	17′ 9″ „	—	9″·71	11′ 9″	14·5	—	Five wave-lengths in the 60 feet.
„ 16	17′ 9″ (a.m.)	south-westerly (light)	9″·7	11′ 2″·8 *	13·9	—	H.W. 10h. 15m. a.m. At 12h. 12m. p.m. in 3′ water current over plot 2′·93 per sec. (1·74 knot), mean of 9 determinations with a float. This was the strongest tide met with till sands dried.
„ 17	18′ 3″ „	—	—	—	—	estd. 2′ 6″	The ridges are even better developed than yesterday.

* Wave-lengths only measured along one section. A ridge intruding a little way into the plot gives the low value. This is presumably just disappearing, when the average L will increase *per saltum* to 14′ 0″·5, with $\frac{L}{H} = 17{\cdot}4$.

and a long subsiding swell afterwards. Again, the irregularity of the wave-lengths in a swell tends to diminish with time: so here, when the tides were falling off, the difference of successive wave-lengths of the tidal sand-ridges diminished thus:

TABLE IX.

June 1, average difference of successive L's = 13·4 per cent. of the mean L.
" 2, " " " " = 11·4 " " "
" 3, " " " " = 10·7 " " "
" 4, " " " " = 4·4 " " "
" 5, " " " " = 6·6 " " "

The increase of uniformity goes on till we come to June 5, when, as has been noted in Table VIII., the diminishing tidal current seems suddenly to have lost control of the wave system. Table VIII. shows how the average daily advance varied from day to day; the subjoined table gives the details for each ridge:—

TABLE X.

DETAILS OF ADVANCE OF RIDGES OF EXPERIMENTAL PLOT (see Fig. 27).

	June 1–2.	June 2–3.	June 3–4.	Average daily advance for each ridge.
Ridge A	45″·87	34″·25	33″·62	37″·91
" B	39″·25	32″·37	26″·25	32″·62
" C	42″·00	31″·62	32″·25	35″·29
" D	38″·75	28″·50	32″·25	33″·17
" E	24″·50	22″·00	28″·50	25″·00
General average for each day	38″·07	29″·75	30″·57	—

From this it will be seen that the slight shortening of the average wave-length was due to the more rapid advance of the rear ridges, and the slower advance of the front ridges. The ridge E was at no great distance from the position where the ebb ceased to have the mastery over the flood; also the water was slightly shallower at E than at A. It seems natural that these circumstances should affect E more than A during the falling off of the tides. The orderly march of the sand-waves is rendered visible to the eye by the diagram (Fig. 27), which strikingly illustrates how the natural undulating surfaces of sand, by the regularity of their form and the precision of their movement, justify and reward investigation.

THEORY OF THE ORIGIN, GROWTH, AND DECAY OF SAND-WAVES IN CURRENTS, AND OF THEIR RELATION TO "CURRENT MARK."*

In the formation of a wave surface from a plane surface, there is differential movement of the parts of the body, accretion occurring at certain positions, and depletion at positions intermediate between them; or, if there be a general accretion or a general depletion going on, then there is an excess of the effect at certain positions and a deficiency of the effect at intermediate positions. It is easy to see in a general way that the sudden checking or quickening of a current of water will produce local alterations in the rate of drift of the sand over which it flows, which will cause inequalities of the otherwise smooth surface. Such I take to be the

* See also a paper, by the author, in the *Scottish Geographical Magazine*, vol. xvii. (January, 1901), on the "Formation of Wave-surfaces in Sand."

current mark of streams which remains a mere ripple on the surface of the sand, whether that surface be otherwise smooth, or whether, as in the circumstances dealt with in this paper, it be thrown into waves which grow to large dimensions. I have repeatedly observed, as I suppose others have also, that all rivers, except perhaps the most sluggish, have a visible pulsation or pulse. In the slower streams, or in those which are rapid, but in which sand only rests in the

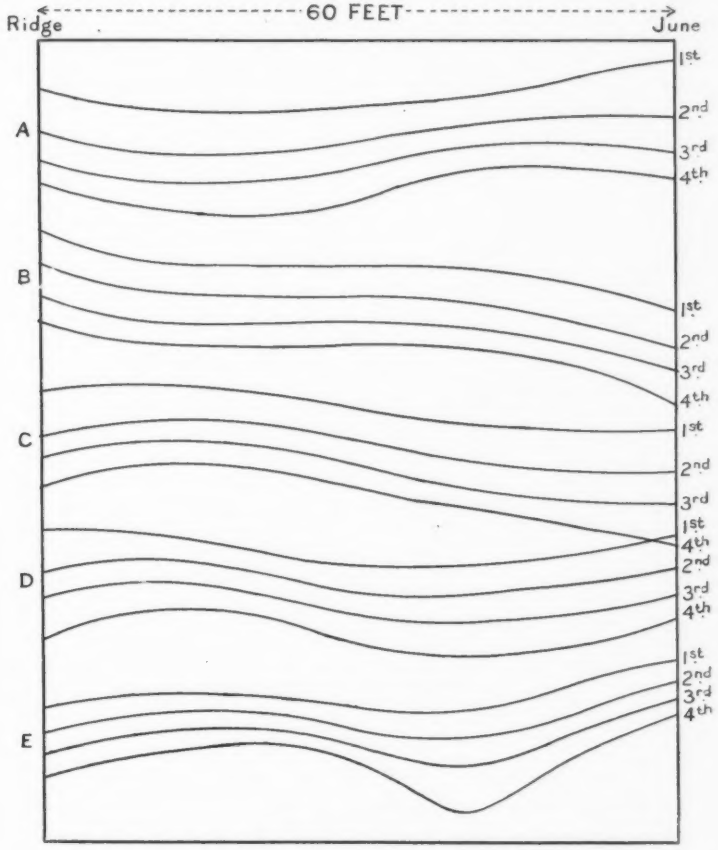

FIG. 27.—PLAN OF FIVE RIDGES SHOWING POSITIONS ON FOUR SUCCEEDING DAYS, DOVEY ESTUARY. SCALE, 1″ = 16′.

backwaters, the current mark is the characteristic sand-wave or ripple. In mid-current it faces down stream, but near the banks the wave-front usually extends diagonally across and down stream, facing somewhat towards the banks, and the drift of the sand may be seen in such cases to be no longer perpendicular to the face of the ridge, indicating that the ripple, as has been said, is not due to the steady action of the current.

The true current-formed sand-wave I find to be produced as soon as the velocity of the stream causes the water to be turbid with a heavy charge of sand in eddying suspension. The process can be watched in the shallow streams of sandy tidal foreshores. Their velocity varies much from point to point, and from minute to minute. Almost as soon as the velocity (the actual value of which, perhaps, depends partly on the depth) is attained at which the water becomes notably turbid, a train of sand-waves arises with startling suddenness, the wave-fronts quickly extend across the stream at right angles to the current, and the amplitude of the sand-wave sometimes becomes so great that the surface of the sand at its crest is nearly on a level with the surface of the water above its trough. The near neighbourhood of a free upper wave surface of the superincumbent fluid makes these sand-waves move up stream * (passing the observer on the bank with a motion readily visible), so that they differ in at least one important respect from the sand-waves described in this paper. But the commencement of the smaller sand-waves, as I have frequently observed, does not require that the water surface should be previously in waves. Therefore, I infer that in deep streams sand-waves will be similarly produced when the velocity reaches the point at which the lower strata of water become heavily charged with sand in eddying suspension. Now, the observations in this paper have shown how steady and how considerable is the growth in amplitude of the sand-waves formed by the action of currents in tideways from the time of their almost sudden creation. But, it may be objected, is not this the well-known current mark on the larger scale suitable to the swifter current? My observations negative this: there is indeed an increase in the size of current mark in the swifter stream, but it is, relatively, a very small increase. The large tidal sand-ridges may be seen covered over with this current mark, which is now a relatively insignificant feature. The fact that the formation of the larger kind of sand-wave is not accompanied by the disappearance of "current mark" is confirmatory of my opinion that the latter is due to the pulsation of the current, for as the current becomes swifter so does its pulse beat more strongly. I consider, then, that the current mark is due to pulsation both in streams of which the average speed is less than that required to throw the sand into eddying suspension, and in streams which have an average velocity greater than that value; but that the formation of the larger kind of sand-waves is due to another mode of action of streams, the velocity of which (apart from pulsation) is sufficient to maintain a considerable drift of sand in eddying suspension. It is incumbent to give an account of the principal movements of the sand-grains which must occur under these conditions, and to show that these movements will produce such a wave-surface. Let us start with Prof. Osborne Reynolds's description † of the steady drift of sand in a rapid current.

"The manner in which a current of water acts on the granular material forming the bed of the current has been the subject of an investigation by various experimenters. It has been found that the primary action is not so much to drag the grains along the bottom, but to pick them up and hold them in a kind of eddying suspension, at a greater or less height above the bed, for a certain distance and then drop them, so that when the water is drifting the sand there is a layer of water adjacent to the bottom of a greater or less thickness charged to a greater or less extent with sand. . . . A certain definite velocity, according to the size and weight of the grains, is required before the water will raise the grains from the bottom . . .; the effect of a uniform

* Cp. the author on "Kumatology," *Geographical Journal*, June, 1899.

† "On certain Laws relating to the Régime of Rivers and Estuaries, and on the Possibility of Experiments on a Small Scale." British Association, 57th Report (Meeting held at Manchester in 1887), p. 556.

current of water over a uniform bed of sand will not be to raise or lower the bed, for, as the charge of sand in the water remains uniform, it must drop as many particles as it raises everywhere on the bed. This is the action of the water in causing a uniform drift. It is also evident that if the charge in the water as it comes to any particular place is less than the full charge due to its velocity, it will pick up from that place more sand than it drops, and so increase its charge at the expense of the bed, which will there be scoured or lowered. And conversely, if the water as it arrives at any place is overcharged, it will relieve itself by depositing more than it picks up, and so raise or silt up the bed."

Under these conditions the drift is uniform *on the whole*, but it will be noticed that the equilibrium is of a peculiarly delicate character, for if across any section there be a slight excess of deposition, then in the next section, the water has not its full charge of sediment, the current "picks up more than it drops," and we have a scour. Let us consider the effect upon the drift of any small protuberance. Above the protuberance there is a convergence of currents from the weather side and lee side, and deposition therefore takes place upon the protuberance,* which is thereby raised. Just to leeward, the water, being deprived of a part of its charge, will scour, *i.e.* lower the bed. Thus we see that any slight inequalities of level will be immediately increased. The mounds so formed will extend themselves laterally at each end† even more quickly than they grow vertically, for there is the same forcing back of the bottom water "towards the centre of the curve" without the opposition and limitation which is imposed by gravity to vertical sinuosities. These actions, it is to be remembered, are described as occurring in a current of more than what we may term the critical velocity, in which the water is turbid with sand in eddying suspension, the conditions being other than those under which we are accustomed to observe (through the *clear* water) rippling action going on either in streams or in shallow wave-water of the sea or lakes, in which the sand is only thrown into such suspension momentarily by the jerk of the wave or of the pulse. The importance of the case we are dealing with lies in the fact that the inequalities not only become systematically arranged in transverse ridge and furrow, regular in form and movement, but that these inequalities grow beyond the ripple stage to what are better described as waves. It is not merely any small inequality which is increased, but any inequality even of considerable size. We must, therefore, specify the conditions which limit that growth. Moreover, in describing the various actions by which vertical inequalities are increased, one must be careful not to lose sight of the fact that such actions, although not exactly rare, are nevertheless the result of some exceptional combination of circumstances which overcomes the normal tendency of gravity to smooth out such inequalities. Therefore we must specify the conditions of decay as well as those of growth. One limit of growth must be the shallowness of the water. When the cross-section of the stream above the crest is reduced by a certain amount, the concentration of the stream there counterbalances the increase in the supply of sand, which is therefore removed from the crest as quickly as it is brought there, and the height of the ridge no longer increases. Any diminution of depth, *e.g.* by falling tide, would then reduce the amplitude of the ridge. In a deep current the height of the ridges is limited by the strength of the eddy which the velocity of the current

* Compare G. H. Darwin's observation of the sand-grains creeping up a ridge from both sides simultaneously when a current was passing over it, *Proceedings Royal Society*, vol. xxxvi. p. 22.

† Compare James Thomson, "On the Winding of Rivers in Alluvial Plains," *Proceedings Royal Society*, 1876 and 1877.

enables it to maintain. If the ridge exceeded a certain height, there would be dead water on the lee side, and the trough would therefore silt up, diminishing the amplitude. It is probable, also, that the height of the ridges is sometimes restricted by the velocity of the water surpassing the limit suitable to the fineness or lightness of the material of which they are composed.* For the development of steep and large sand-waves, it is presumably necessary that the velocity should decrease somewhat rapidly as we go downwards through the lower layers of water, so that there may be much differential movement and a fairly definite surface of separation between the watery sand and the sandy water. Again, suppose large and steep ridges of sand to be exposed to a torrential current, or such ridges of light non-coherent mud to be exposed to a fairly strong current, then the difference of pressure upon the weather and lee faces respectively will cause a bodily sliding of the ridges into the troughs. When wading among the tidal sand-ridges, one constantly caused such slips. A moderate range in the sizes of sand-grains helps to preserve a definite surface of separation, the larger sorts being there concentrated.

Prof. Osborne Reynolds † found that in his model estuaries the ripples "formed by the alternating action of the tide" had a wave-length equal to twelve times their amplitude (L = 12H). The tidal sand-ridges observed by me at low water on the dry sandbanks were often in a condition of partial decay, owing in some cases to violence of the last runnings of the ebb, and in others to a falling off of the tide after springs. The greatest recorded steepness for the average of a train of (fifteen) wave-lengths was L/H = 13·39. How far alternation of tidal currents was in these cases responsible for the observed steepness is not quite clear, but I think that a slow return current does not necessarily act so as to increase the steepness of the ridges, although it may improve the regularity of the wave-fronts. It is to be observed in this connection that the salient angle for the direct current is the re-entrant of the return current, and that the return current will therefore check any tendency of the direct current to find a channel through the ridges. I have not at present made observations upon large sand-waves in deep non-tidal streams,‡ and am unable to state positively what are the steepest sand-waves there formed.

Before the reading of the paper, the PRESIDENT said: We are now well acquainted with our friend who is going to read the paper to-night. I am glad to be the first to announce publicly that he has received the degree of Doctor from the Victoria University—a gratifying endorsement of our conferring upon him one of our awards last year in recognition of his services to Geography. The paper he is going to read to us to-night is entitled "Travels in Search of Waves during 1900." I now call upon Dr. Vaughan Cornish to read his paper.

After the reading of the paper, the following discussion took place:—

Captain WILSON BARKER: I am afraid I cannot add much to the very interesting and beautifully illustrated paper Mr. Vaughan Cornish has given us this

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* In the interval between the writing of this paper (Oct. 1900) and its publication, I have made observations upon the rate of subsidence of (snow) particles as related to the production of silt and scour respectively.

† 'First Report of Committee on the Action of Waves and Currents,' etc., pp. 16, B.A. 59th Report, Meeting of 1889.

‡ Since writing this sentence I have seen, but not measured, sand-waves similar to those described in this paper, in the Fraser river, British Columbia, above the locality to which the tide extends.

evening. My observations have been almost entirely confined to waves at sea. He has pointed out the existence of a very considerable difference of opinion on the height of waves, and of course it is an extremely difficult thing to have any correct idea of the altitude within a few feet. I am quite prepared to accept the statement that waves have been seen at sea up to 40 or 50 feet in height; but when I gave the approximate height, I of course meant the average height. As a rule, my experience is that waves in high southern latitudes are higher and more regular than those in any other parts of the world; that is a thing we might naturally expect. The motions that Mr. Vaughan Cornish speaks of, of the wind blowing up the waves, is also very interesting, showing the little ripple-marks on the waves, and when the wind is very strong we get what we call spoon-drift blowing off the top of the waves in addition. I do not think I can say anything more, except that I have been extremely interested in Mr. Vaughan Cornish's beautiful views.

The PRESIDENT: Have you any method of measuring the height of waves?

Captain WILSON BARKER: The general method is to mount the rigging and take observations from there; but I was in a sailing ship where we had a standard compass at a considerable elevation with a platform round it, which offered a most favourable opportunity for taking wave observations at different heights. When a ship is running before the wind she is more or less on an even keel, under which condition the chances of error in estimating wave-heights is reduced to a minimum, particularly when a number of observations are taken; though, of course, all estimates of heights can only be given as approximate.

Dr. MILL: There is little that I am able to say on this most interesting paper. It has been a great pleasure to hear the extremely clear manner in which Dr. Vaughan Cornish—as I am pleased to be able to call him—has shown us the remarkable similarity between the effects of this rhythmic wave-movement in air, water, and sand. It is, to my mind, one of the great advantages of geography as a science that it unifies a number of subjects which are at first sight apparently remote, and I rather think it would have surprised the founders of this Society if they had foreseen an occasion when the forms of clouds would be taken in as part of the science of geography. Dr. Cornish has shown us, not only by his clear explanations, but by his really magnificent photographs, how unmistakable this similarity is. The one point on which I am not quite clear, is whether all those ridges shown in the estuaries are really parts of waves, or whether they are merely heaps of sand accumulated on a surface which one might assume to be level. That, I have no doubt, has been duly considered in the full paper, which as yet I have not seen. It is an extreme pleasure to me to hear the description of these gravel ridges which are so familiar to me along the shore of the Moray Firth, and of the peculiar phenomena seen on the sands at Grange. It has struck me that a good deal of the peculiarity of the latter phenomenon must be due to the somewhat unusual composition of the sand, which contains a good deal of carbonate of lime worn from the lower carboniferous rocks of that region. The sand has a peculiar tenacity; you can feel the surface firm but movable when you put your hand down, something like the skin of a dog. Dr. Cornish has shown admirable tact in presenting his matter, and has presented it so briefly and so clearly as to be a pleasure to all hearers.

The PRESIDENT: It is now four years since Mr. Vaughan Cornish gave us the first of an interesting series of papers on the subject of the formation of waves and sands and sea-beaches. His first paper, I remember, was on the sand-dunes, and was mainly theoretical, derived from his observations on beaches in England. His second paper on that subject was more complete, for he had visited the sand-dunes of Egypt. To-day he has taken us over the sands and waves of the sea

and clouds and snow, and I think he has vindicated the practical character of his investigations as well as their scientific importance, especially with regard to the complicated currents in estuaries being traced by these sand-ridges. I am sure you will all join in a unanimous vote of thanks to Dr. Vaughan Cornish for his very interesting paper, and for the extremely beautiful illustrations of clouds and sand-ripples.

SOME RECENT CENSUS REPORTS.

The United Kingdom.—The preliminary report of the census taken on March 31 shows that the population of England and Wales is 32,526,075; of Scotland, 4,471,957; of Ireland, 4,456,546; and of the Channel Isles and the Isle of Man, 150,599; total, 41,605,177. The increase during the past decade has been 3,724,413, or 9·8 per cent., while for the period 1881–91 it was 8·2. The population of Ireland continues to decrease, while the growth in Scotland has been exceptionally large, so that the population of the latter now exceeds that of Ireland.

The increase in the population of England and Wales has been 3,523,550, or 12·15 per cent., and is half a per cent. greater than in the previous decade. There is an excess of females over males amounting to 1,082,619, which figures will be somewhat reduced when the returns of men serving in the army, navy, and merchant service come in. Excluding the counties immediately round London, the growth of which is to a large extent that of the metropolis itself, those which have made the greatest strides are Lancashire, with an addition to its population of 262,694; the West Riding of Yorkshire, with 166,438; Glamorgan, with 133,138; Durham, with 112,821; and Staffordshire, with 108,360. If the percentages be taken, Glamorgan heads the list, with 28·5 per cent., and is followed by Northumberland, 21·4; Worcestershire, 20·5; Derby, 18·6; and Nottingham, 18·5. In twelve counties there has been an appreciable decrease of population, among which Oxford has lost 6635 inhabitants, Devon 5077, and Norfolk 4863. The greatest proportional loss, however, has been in Montgomery, namely, 5·4 per cent.; and Oxford with 4·6, and Rutland with 4·6, are next in order.

The Isle of Man and the Channel Isles, with the exception of Guernsey and Alderney, have a smaller population than in 1891.

The following table shows the populations in 1891 and 1901, and the increase or decrease in percentages. The density is 557·8 to the square mile.

	Popn. in 1901.	Inc. or dec. per cent.
England and Wales	32,526,075	12·15
62 Administrative Counties	23,387,192	11·2
67 County Boroughs	9,138,883	13·3
Counties: England—		
Bedfordshire ...	171,700	6·4
Berkshire ...	180,366	2·4
Buckinghamshire	196,844	5·4
Cambridgeshire ...	120,634	0·0
Isle of Ely ...	64,494	1·8
Chester	601,070	12·2
Cornwall	322,960	0·1
Cumberland ...	266,924	0·1
Derbyshire ...	504,577	18·6
Devonshire ...	437,210	−1·1
Dorsetshire ...	202,092	4·4
Durham	833,614	15·8
Essex	816,503	41·1
Gloucestershire ...	331,516	2·3
Herefordshire ...	114,150	−1·4
Hertfordshire ...	258,045	13·9
Huntingdonshire	54,127	−1·6
Kent	936,003	15·3
Lancaster... ...	1,827,390	16·8
Leicestershire ...	225,896	12·0
Lincolnshire—		
Holland ...	77,583	1·8
Kesteven ...	103,958	−1·3
Lindsey ...	206,497	3·7
London	4,536,063	7·3

	Popn. in 1901.	Inc. or dec. per cent.
Counties: England—*contd.*		
Middlesex ...	792,225	45·9
Monmouthshire ...	230,800	13·5
Norfolk	313,438	−1·5
Northamptonshire	207,467	9·6
Soke of Peterborough ...	41,119	16·7
Northumberland...	388,059	21·4
Nottinghamshire	274,684	18·5
Oxfordshire ...	137,118	−4·6
Rutlandshire ...	19,708	−4·6
Shropshire ...	239,297	1·0
Somersetshire ...	385,060	1·8
Southampton (Hampshire) ...	377,118	12·8
Isle of Wight ...	82,388	4·7
Staffordshire ...	879,618	14·0
Suffolk—Eastern	189,152	3·1
„ —Western	117,535	−3·1
Surrey	519,521	24·0
Sussex—Eastern	261,691	14·9
„ —Western	151,541	7·5
Warwickshire ...	347,691	15·4
Westmoreland ...	64,411	−2·7
Wiltshire	271,372	3·4
Worcestershire ...	358,356	20·5
Yorkshire—East Riding	145,194	2·8
Yorkshire—North Riding	285,671	0·6
Yorkshire—West Riding	1,460,861	12·9
Wales—		
Anglesey	50,590	1·0
Brecknock ...	54,211	5·5
Cardigan	61,076	−3·8
Carmarthen ...	135,326	3·6
Carnarvon ...	125,669	6·9
Denbigh	131,588	10·6
Flint	81,490	5·8
Glamorgan ...	601,092	28·5
Merioneth ...	48,774	−0·2
Montgomery ...	54,892	−5·4
Pembroke ...	87,910	−0·4
Radnor	23,263	6·8

In the following table are given the boroughs with more than 100,000 inhabitants, their population, and increase in percentages, changes in the municipal areas being accounted for :—

Borough.	Popn. 1901.	Increase per cent.
Birkenhead	110,926	11·1
Birmingham	522,182	9·2
Blackburn	127,527	6·2
Bolton	168,205	14·8
Bradford	279,809	5·3
Brighton	123,478	6·6
Bristol	328,842	10·2
Cardiff	164,420	27·5
Croydon	133,885	30·4
Derby	105,785	11·4
Gateshead	109,887	29·4
Halifax	104,933	7·4
Kingston-upon-Hull ...	240,618	20·0
Leeds	428,953	16·7
Leicester	211,574	21·2
Liverpool	684,947	8·8
Manchester	543,969	7·6
Newcastle-upon-Tyne ...	214,803	15·3
Norwich	111,728	10·7
Nottingham	239,753	12·1
Oldham	137,238	4·4
Plymouth	107,509	20·9
Portsmouth	189,160	18·8
Preston	112 982	5·0
Salford	220,956	11·5
Sheffield	380,717	17·4
Southampton	104,911	27·7
Sunderland	146,565	11·3
West Ham	267,308	30·5

Besides these twenty-nine boroughs, there are thirty-eight others with populations ranging down to 24,868 (Canterbury), all of which have grown during the past decade except Bath, Chester, and Huddersfield. The City of London continues to lose its resident population, which has fallen from 37,705 to 26,897. Several other metropolitan boroughs situated in the central parts of the area have a smaller population, while those in the outskirts have gained a large addition, especially Fulham and Wandsworth.

The population of Scotland, now 4,472,000, has increased during the decade by 446,353, or 11·09 per cent. As is shown in the following table, the population has increased in nineteen counties and decreased in fourteen. The density has risen to 150·1 to the square mile.

County.	Popn. in 1901.	Inc. or dec. per cent.	County.	Popn. in 1901.	Inc. or dec. per cent.
Aberdeen	304,420	7·2	Kinross	6,980	4·6
Argyll	73,665	−0·6	Kirkcudbright ...	39,407	−1·4
Ayr	254,436	12·4	Lanark	1,139,289	21·1
Banff	61,487	−0·3	Linlithgow	65,699	2·4
Berwick	30,816	−4·6	Nairn	9,291	1·5
Bute	18,786	2·1	Orkney	28,698	−5·7
Caithness	33,859	−8·9	Peebles	15,066	2·1
Clackmannan ...	32,019	−3·4	Perth	123,262	0·9
Dumbarton	113,870	16·2	Renfrew	268,934	16·5
Dumfries	72,569	−2·3	Ross and Cromarty	76,421	−2·9
Edinburgh	488,647	12·5	Roxburgh	48,793	−8·8
Elgin	44,808	3·1	Selkirk	23,339	−15·8
Fife	218,843	15·0	Shetland	28,185	−1·8
Forfar	284,078	2·3	Stirling	142,338	20·6
Haddington ...	38,662	3·4	Sutherland	21,550	−1·6
Inverness	90,182	0·1	Wigtown	32,683	−9·4
Kincardine	40,918	15·3			

Twenty-two towns contain more than 20,000 inhabitants, and of these the following nine contain over 50,000:—

Aberdeen	153,108	Greenock	67,645
Dundee	160,871	Leith	76,667
Edinburgh	316,479	Paisley	79,355
Glasgow	760,423	Partick	54,274
Govan	76,351		

There are no data available for comparison with the populations of 1891. The additions have been in Edinburgh (14·8 per cent.), Glasgow (15·5), and Aberdeen (22·9); but these are due in part to enlargement of the city areas. Some of the smaller towns show a much greater rate of increase, as, for instance, Motherwell (62·5), Partick (48·6), and Wishaw (36·8).

The population of Ireland has fallen to 4,456,546, but the decrease is less than during previous decades, with the exception of 1871–81, being 248,204, or 5·3 per cent. The decrease has been greatest in Connaught, 9·7 per cent., and least in Ulster, 2·4 per cent.

County.	Popn. in 1901.	Inc. or dec. per cent.	County.	Popn. in 1901.	Inc. or dec. per cent.
Dublin	447,266	+7·3	Carlow	37,723	10·1
Down	289,335	+7·3	Kilkenny	78,821	9·9
Antrim	461,240	+7·0	Kildare	63,469	9·6
Monaghan	74,505	13·6	Armagh	125,238	9·2
Cavan	97,368	13·0	Waterford	87,030	9·1
Roscommon	101,639	12·8	Galway	192,146	9·0
Tyrone	150,468	12·2	Louth	65,741	8·6
Fermanagh	65,243	12·0	King's	60,129	8·3
Leitrim	69,201	12·0	Limerick	146,018	8·1
Cork, W.R.	131,668	11·6	Kerry	165,331	7·7
Longford	46,581	11·5	Wexford	103,860	7·3
Meath	67,463	11·4	Mayo	202,627	7·3
Clare	112,129	11·2	Donegal	173,625	6·5
Sligo	84,022	11·0	Tipperary, N.R. ...	68,527	6·2
Tipperary, S.R. ...	91,227	10·7	Wicklow	60,679	5·9
Queen's	57,226	10·4	Cork, E.R.	273,145	5·7
Westmeath	61,527	10·3	Londonderry	144,329	5·1

Only the first three have gained in the number of their populations, and this is due, for the most part at least, to the growth of Dublin and Belfast. 3,310,028 persons returned themselves as Roman Catholics, a diminution of 237,279, or 6·7 per cent. Other religious bodies have also declined in numbers, except Methodists.

Thirteen towns with a population exceeding 10,000 have increased during the decade. Of these the following have more than 50,000 inhabitants:—

Town.	Population in 1901.	Increase per cent.
Belfast	348,965 ...	27·8
Dublin	289,108 ...	7·6
Cork	75,978 ...	0·8

In seven other towns there has been a decrease, ranging from 6·9 per cent. in Drogheda to 0·7 in Limerick.

India.—The census taken on the night of March 1, 1901, shows that the population of India has risen since 1891 from 287,317,048 to 294,266,701, or only 2·42 per cent., whereas in the preceding decade the increase was 11·2 per cent. This result is mainly due to the figures for the native states, in which there has been a decrease of 4·34 per cent. In British India, however, the rate of increase has been only 4·44 per cent., and if the tracts now for the first time included in the reports be neglected, the increase for the whole of India is reduced from 2·42 to 1·49 per cent. How far the decline is due to famine and the plague, or to emigration induced by high prices and density of population, cannot yet be ascertained.

Provinces.	1901.	Increase or decrease per cent.
Ajmer-Merwara ...	476,330	−12·17
Assam	6,122,201	+12·67
Bengal	74,713,020	+ 4·72
Berar	2,752,418	− 4·99
Bombay (Presidency)	18,584,496	− 1·53
Burma	9,221,161	+18·66
Central Provinces	9,845,318	− 8·71
Coorg	180,461	+ 4·28
Madras	38,208,609	+ 7·24
North-West Provinces	34,812,174	+ 1·63
Oudh	12,884,150	+ 2·40
Punjab	22,449,484	+ 7·58
Baluchistan ...	810,811	—
Andamans ...	24,499	+56·95
Total ...	231,085,132	+ 4·44

Native States.	1901.	Increase or decrease per cent.
Haidarabad ...	11,174,897	− 3·14
Baroda	1,950,927	−19·23
Mysore	5,538,482	+12·03
Kashmir	2,906,173	+14·24
Rajputana ...	9,841,032	−18·1
Central India ...	8,501,883	−17·5
Bombay States ...	6,891,691	−14·49
Madras States ...	4,190,322	+13·23
Central Provinces States	1,983,496	− 8·19
Bengal States ...	3,735,715	+13·33
North-West Provinces States ...	799,675	+ 0·91
Punjab States ...	4,438,816	+ 4·12
Burma States ...	1,228,460	—
Total Native States ...)	63,181,569	− 4·34
Total all India	294,266,701	+ 2·42

The area, then, in which the population has decreased on the whole may be roughly defined as a triangle, with its base extending from Rajputana to the south of the Bombay Presidency, and with its apex at the western boundary of Sambalpur, to which Kathiawar Gujrat and Cutch must be added.

The following twenty-eight towns have a population of more than 100,000:—

Calcutta (with suburbs) ...	1,121,664	Bangalore	159,030
Bombay	770,843	Howrah	157,847
Madras	509,397	Patna	135,172
Haidarabad (with suburbs) ...	446,291	Nagpur	124,599
Lucknow	263,951	Srinagar	122,536
Rangoon	232,326	Lahore	120,058
Delhi	208,385	Meerut	118,642
Benares	203,095	Surat	118,364
Cawnpur	197,000	Bareilly	117,433
Agra	188,300	Karachi	115,407
Mandalay	182,498	Poona (with suburbs)	111,385
Allahabad	175,748	Madura	105,501
Amritsar	162,548	Trichinopoli	104,690
Jaipur	159,550	Baroda	103,782

Of these towns, seventeen have increased in population during the decade, the largest additions being 35·2 per cent. in Howrah, 28·83 in Rangoon, 24·3 in Calcutta, and 20·67 in Madura, while Lahore lost 32·11 per cent., Poona 30·91, and Patna 18·17. The reduction in the urban population is not confined to the districts which have fewer inhabitants; for besides Lahore (−32·11), Bangalore, for instance, has lost 11·83 per cent., while, on the other hand, the city of Haidarabad has gained 7·53 per cent. In addition to the above, there are thirty-one towns in India with populations between 100,000 and 50,000.

German Empire.—The census of the German Empire was taken on December 1, 1900, and exhibits a greater rate of increase than has taken place in any previous lustrum. The percentage for 1895–1900 is 7·78, and for 1890–95 is 5·77, and consequently the rate of increase for the ten years has been 14 per cent., or 1·85 per cent. greater than in England and Wales. The density, however, is under 270, or less than half that of England and Wales. The population has increased in all the states, but more especially in Hamburg, Bremen, and Lübeck.

States.	Population in 1900.	Increase per cent.	States.	Population in 1901.	Increase per cent.
Prussia	34,463,377	8·19	Anhalt	316,027	7·75
Bavaria	6,175,153	6·13	Schw.-Sondershausen	80,678	3·34
Saxony	4.199,758	10·88	Schw.-Rudolstadt ...	92,657	4·48
Würtemberg ...	2,165,765	4·07	Waldeck	57,913	0·25
Baden	1,866,584	8·18	Reuss-Greiz ...	68,287	1·21
Hesse	1,120,426	7·83	Reuss-Schleiz ...	138,993	5·19
Mecklenburg-Schwerin	607,835	1·74	Lippe-Detmold ...	139,238	3·25
Mecklenburg-Strelitz	102,628	1·07	Schaumb.-Lippe ...	43,132	4·63
Saxe-Weimar ...	362,018	6·72	Hamburg	768,349	12·72
Oldenburg	398,499	6·62	Bremen	224,697	14·41
Brunswick	464,251	6·92	Lübeck	96,775	16·14
Saxe-Meiningen ...	250,683	7·13	Alsace-Lorraine ...	1,717,451	4·66
Saxe-Altenburg ...	194,273	7·74			
Saxe-Coburg-Gotha	229,567	5·99	German Empire	56,345,014	7·78

The several provinces of Prussia have also gained population, except East Prussia, which has lost 0·61 per cent. of its inhabitants. Westphalia with 18·01 per cent., the Rhine province with 12·79, and Brandenburg (exclusive of Berlin) with 10·14 per cent., have made the greatest strides.

Thirty-three towns of the empire have populations exceeding 100,000. Of these, Berlin is by far the largest, having a population of 1,884,345; it has increased during the five years by 207,041, or 12·3 per cent. With its suburbs, Charlottenburg (189,300 inhabitants), Schöneberg (99,000), Rixdorf (90,000), and others, it contains between $2\frac{1}{4}$ and $2\frac{1}{2}$ millions. Hamburg comes next, with a population of 704,969, and an increase of 12·7 per cent. Several other towns show a much greater growth. Nuremberg, with 260,743 inhabitants, has increased by 60·6 per cent., Manheim (140,384) by 54·1, and Stettin (209,988) by 49·2. Crefeld alone (106,887) has lost a small number, namely, 358. Of the port-towns Kiel has increased the most, by 24·9 per cent. The aggregate increase in the above towns has been 13,666,340, or 15 per cent., during the five years' period, and since 1875 they have increased by over 116 per cent.

Austria-Hungary.—The census of December 31, 1900, gives as the home population of Austria, *i.e.* the portion of the empire on this side the Leitha, 26,107,000 souls, an increase, during the last decade, of 9·3 per cent., as compared with 14 per cent. in the case of Germany. Of the separate provinces, Lower Austria, which includes the capital of the empire, stands first with an increase of 16 per cent.; Carinthia and Carniola, in which the proportion of small centres is highest, standing at the bottom of the list with 1·8 and 1·9 per cent.

The great differences in the race and economic conditions of different portions of the population naturally cause great variations in its development, the primary causes for which are to be sought in the influence of geographical factors. Thus a series of districts which show a decrease of population follows the line of the Central Alps, while an increase far above the mean rate is shown by the industrial districts around Vienna and Prague, in the mining districts of Northern Bohemia, Eastern Silesia, and Northern Moravia, as well as in certain parts of Galicia and Dalmatia. Striking instances are supplied by Floridsdorf, close to Vienna, and by Ostrau in Moravia, which show increases of 44 and 56 per cent. respectively. The density has risen since 1890 from 31 to 34 to the square mile, and in Lower Austria from 52 to 60, Silesia and Bohemia coming next with 51 and 47 respectively. The Alpine provinces of Tirol and Salzburg have 12 and 10 only. The excess of the country over the town population shows a continued decrease, the proportion of 58 : 42 in 1890 having fallen to one of 54 : 46. Especially marked is the increase of the towns of between 20,000 and 100,000 inhabitants. The following table shows both the population of the larger towns within the administrative areas and that of the larger agglomerations of population where these form in reality single units. As in the case of Vienna (cf. vol. xvii. p. 427), the increase in the peripheral districts of the towns far exceeds that in their centres. Thus, while there is a general movement in the agricultural districts *towards* the towns, within these there is a centrifugal tendency. In Prague, *e.g.*, while the heart of the city has actually lost population (in one division, to the extent of 22 per cent.), the outer divisions have increased in some cases by a half or even three-quarters. Including these, Prague now stands, in the matter of population, between Leipzig and Munich, or between Leeds and Birmingham. The results for Hungary give a *total* of 19,203,531. Thus, out of every ten inhabitants of the monarchy about six live in Austria and four in Hungary, the precise ratio being 58 to 42. The increase in the latter is even greater than in the former, being 9·96 per cent. With its larger area, Hungary

POPULATION OF AUSTRIAN TOWNS.

	Administrative area.	Increase per cent.	Wider aggregate.	Increase per cent.
Vienna	1,662,000	22	—	—
Prague	204,000	12	460,000	30
Triest	179,000	13	170,000	16
Lemberg	160,000	25	—	—
Graz	138,000	23	—	—
Brünn	109,000	15	—	—
Krakau	91,000	22	123,000	28
Czernowitz	70,000	28	—	—
Pilsen	68,000	36	—	—
Žižkow	60,000	46	See Prague	
Linz	59,000	23	72,000	30
Kgl. Weinberge	52,000	52	See Prague	
Reichenberg	34,000	11	54,000	20
Ostrau (Moravia)	30,000	56	79,000	65

comes considerably behind as regards density, with only 23 to the square mile. The attraction of the capital is here still greater than in Austria, Budapest showing an increase, since 1890, of 45 per cent., which gives it a population of 713,383.

In 1874, at the time of the union of Ofen with Pest, it scarcely reached 300,000. The division as regards religions is as follows: Roman Catholics almost 61 per cent., Protestants over 14 per cent., and Jews nearly 24 per cent. In Bosnia and Herzegovina, a new census will presumably not be taken till 1905, the last having taken place in 1895.

Italy.—The census of Italy was taken on the night of February 9. Since the last census, on December 31, 1881, the population has increased from 28,459,628 to 32,449,754, or by 14 per cent. in the nineteen years. The mean annual increase, 7·34 per 1000, is rather greater than in the decade 1861–71, and much larger than in 1871–81, when it was only 6·19. The provinces of Rome, Liguria, and Sicily have increased the most. In the Basilicata alone there has been a decrease, of 34,504 persons.

Departments.	Population in 1901.	Mean ann. inc. or dec. per 1000.	Departments.	Population in 1901.	Mean ann. inc. or dec. per 1000.
Piedmont	3,326,311	4·4	Abruzzi and Molise...	1,442,365	5·0
Liguria	1,080,944	11·1	Campania	3,142,378	4·4
Lombardy	4,278,188	8·5	Apulia	1,949,423	11·9
Venetia	3,130,429	5·9	Basilicata (Potenza)	490,000	−3·4
Emilia	2,451,752	6·4	Calabria	1,375,760	4·9
Tuscany	2,548,154	8·0	Sicily	3,529,266	10·7
Marches	1,064,749	7·0	Sardinia	789,314	8·2
Umbria	644,367	6·6			
Lazio (Latium) ...	1,206,354	17·5	Kingdom of Italy	32,449,754	7·3

No return has yet been made of the urban population.

Switzerland.—The census of Switzerland was taken on December 1, 1900. The resident population is 3,313,817, according to the preliminary returns, and since 1880 has increased from 2,831,787, or by fully 17 per cent. All the cantons have increased populations, with the exception of Glarus, which has lost about 1800 inhabitants, or 5·4 per cent.; and Uri, which, however, has been growing since 1888. The town of Basel, with the communes attached to it, has increased by 52·2 per cent., Zürich by 27·6, and Geneva by 24·8. Other cantons containing no very large towns have also increased considerably; as, for instance, Soleure 18 per cent., Neuchâtel 16 per cent., the Valais and Vaud 12·5, and Uri 14. There are two towns with more than 100,000 each, namely, Zürich, 150,228, and Basel, 107,287; Bern has 63,994, and Geneva 58,867. All these have grown very much since the last census in 1888—in the case of Zürich, 59½ per cent. Six other towns, namely, Lausanne, St. Gallen, Chaux de Fonds, Lucerne, Winterthur, and Neuchâtel, have more than 20,000 inhabitants each. Probably the suburbs Plainpalais, Eaux Vives, and Sacconex will shortly be incorporated with Geneva, and then Switzerland will have a third town of more than 100,000 inhabitants.

Smaller Nationalities.—The population of Norway, as given in the preliminary report of the census of December 3, 1900, is 2,231,395, of whom 1,606,864 are inhabitants of the rural districts, and 624,531 of the towns. During the previous ten years the population increased by 230,478, or 11·5 per cent. There has been an increase in all the districts except Nedenes, but the towns have, as in other countries, increased in a greater ratio than the country districts. Christiania contains 225,686 inhabitants, and since 1891 has received an addition of over 48 per cent. Bergen has increased by over 34 per cent., up to 72,179. No other town has more than 50,000 inhabitants.

A census of the Netherlands was taken on December 31, 1899, when the total population was 5,103,924. The largest additions to the population since 1899 took place in North and South Holland (20·51 and 16·71 per cent. respectively), the

former containing the towns of Amsterdam, Haarlem, Zaandam, and Helder; the latter Rotterdam, Dordrecht, the Hague, Leiden, etc. Friesland has increased by only 1·4 per cent.

The population of Denmark, enumerated on February 1, 1900, is 2,447,441, and is 12·66 per cent. larger than in 1890. The rural population is 1,511,324, and has increased by only 5·17 per cent.; while the seventy-six towns contain 936,117 inhabitants, or 27·29 per cent. more than in 1890. Copenhagen (378,280 inhabitants) has gained 17·69 per cent.; Frederiksberg (76,237), 62·37 per cent.; and Aarhus (51,909), 55·85 per cent. There are ten other towns with more than 10,000 inhabitants each, all of which have made considerable strides. Esbjerg has gained 225·1 per cent., and has now 13,365 inhabitants.

Servia had on December 31, 1900, a population of 2,535,066, having increased by 7·2 per cent. in five years. Belgrade has 70,516 inhabitants.

The population of Crete, enumerated in June, 1900, was 307,369, including 6096 foreigners. The noteworthy feature is the decrease of the Mohammedans, who now number only 33,281. Candia has 22,331, and Canea (the capital) 20,973 inhabitants.

The Mexican census of October 28, 1900, shows that the population of the republic is 13,570,545, or 7·6 per cent. larger than in 1895. The most densely peopled districts are the Federal District, and those to the south of the city of Mexico, while the north, west, and east are more sparsely populated. The capital has 530,723 inhabitants.

Owing to the late war, and the misery which accompanied it, the population of Cuba has diminished by 58,890, or 3·6 per cent. of the number at the census of 1887. It is believed that until the outbreak of hostilities the Cubans multiplied at the usual rate, and in the ordinary course of events the number would in October, 1899, have amounted to 1,800,000, whereas the actual figures were 1,572,979. Havana has 235,981 inhabitants, Santiago 43,090, Matanzas 36,374, and Cienfuegos 30,038.

Porto Rico has added 16 per cent. to its inhabitants during the twelve years, and has now 953,243. The density is 264 to the square mile, while in Cuba it is only 35·7. The proportion of white men, 61·8 per cent., is less than in Cuba (66·9), but greater than in the other Antilles. The urban population is small, only 8·7 per cent. of the people living in towns of over 8000 inhabitants.

THE MONTHLY RECORD.

EUROPE.

Geological History of the Rivers of East Yorkshire.—This subject is dealt with by Mr. F. R. Cowper Reed, assistant to the Woodwardian Professor of Geology at Cambridge, in the Sedgwick Prize Essay for 1900. The essay is divided into chapters, treating in turn of the general characters of East Yorkshire, its geological structure, physical history, etc., the main subject of the study, viz. the history of the relations of the rivers to the geological structure, being reserved for Chapter V. Following in the main the lines suggested by Prof. W. M. Davis in the article which appeared in vol. v. of the *Geographical Journal*, the author regards the present drainage system as the successor of one which developed on a more or less continuous covering of cretaceous strata, ultimately wearing this down so as to produce a peneplain of diverse composition. The original surface sloped to the east or south-east, thus determining the original direction of the primary

consequent streams, the upper courses of which are represented at the present day by the upper portions of the Tees, Swale, Ure, Nidd, Wharfe, and Aire. In some cases their middle and lower courses can also be traced, but except in the case of the Aire-Humber are now rarely continuous, being broken up by capture and diversion into several disjointed portions. Thus the original course of the Tees is placed by the author along the line of the Leven and Esk, and of the Ure, along that of the Elphin beck, Hole beck, and Rye. The first cycle of development was marked by important changes, due to the formation of subsequent streams, the most successful of which captured the headwaters of many of the original consequents. Thus the Ouse, following the Triassic outcrop, appears to have captured the Wharfe and Nidd, and finally the Ure, which had previously captured the Swale. The second cycle was initiated by the strong Miocene uplift, giving rise to the new east to west watershed along the line of Glaisdale moor. The adjustments of streams previously brought about were for the most part revived, much of the new drainage being along the revived subsequent streams. The Ouse would therefore at once advance into primary importance. During this second cycle all the main topographic features of the region were developed, and many minor adjustments of river-courses, traced in detail by the writer, took place. The changes in the drainage of the Vale of Pickering may be specially referred to. In the first stage, the Rye (= the beheaded Ure) continued to flow through a gap in the Cretaceous escarpment in the direction of Bridlington. Meanwhile the subsequent stream flowing towards Filey along the Kimmeridge clay syncline, was rapidly growing headwards, until in course of time it tapped the original consequent Ure, the lower portion of which became a "dry chalk valley." At the close of the second cycle two only of the important features in the present drainage were undeveloped, the first being the reversal of the drainage of the Vale of Pickering above described, and its discharge through the Malton gorge. This was due to the damming back of the waters of the vale by the broad band of drift deposited along the coast-line, and the formation of a lake, which in turn was drained south-west by a *col* over the Howardian hills. In a similar manner the present headwaters of the Derwent, which once flowed east by the New Cut to Scalby, were diverted southwards by the Forge valley to the Vale of Pickering. The concluding cycles, though marked by oscillations in the level of the land, brought little change in the system of drainage.

The Bend of the Rhine.—Herr F. von Huene contributes an interesting study of the orography of the main bend of the Rhine to the *Geographische Zeitschrift*. The contrast to north and south of a point of vantage in the neighbourhood of Basle is graphically described, and the characteristic features of the drainage-systems of the north-western Jura and the south-western Schwarzwald are pointed out. The influence of geological structure is then traced, directly in the river-system of the Schwarzwald and the Jura ranges, and indirectly in the subsequent drainage of the plateau between the Jura range and the Rhine valley.

Geological History of Wallachia.—In a note in the *Comptes Rendus* of the Paris Academy of Sciences (vol. 132, p. 1140), M. de Martonne calls attention to certain points in the geology of the lands bordering the Carpathians to the south, which, he thinks, throw light on the history of the formation of the valleys of Wallachia and even the Danube itself. The writer had previously pointed out that the "Sub-Carpathian depressions" which lie along the foot of the range in Wallachia, were probably tectonic in origin, and had exercised an important influence on the formation of the transverse valleys of the range. His recent researches are held to have confirmed this theory. The subsidence to which the depressions in question were due seems to have been localized, in Western

Wallachia, on the immediate edge of the crystalline range of the Higher Carpathians, whereas in Eastern Wallachia it has affected the whole fringe of the range. In the region of subsidence, where eroding agencies have been paralyzed, many of the valleys have hardly been excavated at all in the diluvial platform, while shallow lakes abound. Many of the Danubian lakes may be ascribed to the effect of this depression, occupying as they do the lower end of valleys blocked by the alluvium which the great river is no longer able to carry away. Western Wallachia, on the other hand, is a region of elevation or relative stability, and the rivers, including the Danube itself, still exercise to the full their office of eroding agents.

The Greek Islands of the Ægean Sea.—To complete his work in Greece, and to enable him to compile a geographical description of the whole territory, Prof. Philippson was obliged to pay a visit in 1896 to the Cyclades and the Magnesian islands. Certain of the islands have been geologically investigated, but of many only a few short notices have been published, and therefore, though Prof. Philippson's journey lasted only two months, he was able to collect a large quantity of new matter, which he has published as an *Ergänzungsheft* to *Petermanns Mitteilungen*. He visited twenty-one islands, which he treats of separately, and then passes on to a general description of the whole groups. The Cyclades, except those in the extreme south-east, are a crystalline mass, connected with the mountains of Attica and Eubœa, in which it is impossible to detect a common line of strike. In the south-east folded sedimentary strata form the islands of Amargos, Anaphi, and Santorin. In Central Greece a folded mountain region of Mesozoic age (chiefly Cretaceous) lies between the crystalline mountains of Attica on the south, and those of Thessaly on the north. At their contact these groups are folded together or abut on one another along faults. This Mesozoic system is prolonged through Central Eubœa into the Magnesian group, where the border zones converge, the crystalline core cropping up through the partly metamorphosed Mesozoic deposits. All the land available for cultivation is utilized, and gardening and viticulture furnish the chief exports. Natural harbours are numerous, but, strange to say, the islanders are not a seafaring folk, a circumstance due, Prof. Philippson suggests, to the Venetian rule. Orographical and Geological maps are appended to the publication.

Lake Ladoga.—Colonel J. de Shokalsky informs us that he has this year continued his limnological investigations on Lake Ladoga (cf. *Journal*, vol. xvi. p. 471), and that they confirm his previous opinion that the lake approaches very near the true polar type. He hopes to visit the lake again in August, and promises us a summary of the general results of his work on its completion.

The Northern Urals.—A new geological map of the Timanski mountains, on the scale of $6\frac{2}{3}$ miles to the inch, has been published by Th. N. Chernycheff, as a result of his and Prof. Backlund's expedition of 1898–99. The map, which is in three sheets, is based on the new surveys of the expedition, and shows, as is remarked by the Academy of Sciences in its report, how erroneous were all the maps of the region which we hitherto possessed.

ASIA.

Rift-valleys of the Sinai Peninsula.—In a paper printed in the *Geological Magazine* for May of the present year, Dr. W. F. Hume notes some of the results, as regards the structural geology of the Sinai peninsula, of a survey executed in 1898–99, and embodied in a map by his colleague, Mr. H. G. Skill. Attention is first called to the important transverse divide which extends across the southern part of the peninsula from the central range to the Gulf of Akaba. The country on opposite sides of this divide is not only of different types, but in many parts of markedly different levels. It is crossed by five passes, connecting valleys

forming five roughly straight lines, all parallel to each other, and to the Gulf of Akaba. Two of these valleys, the Shelala um Raiyig and the Raib Melhadge, are shown to belong to the category of rift-valleys, bounded generally by steep slopes and often differing completely in geological structure on the two sides. The other valleys are considered to be rift-valleys * on account of their parallelism with the two above-mentioned, while other valleys in Western Sinai present similar features. Those to the west of long. 34° E. show a parallelism with the Gulf of Suez, while a third or transverse system may also be traced. The principal structural features of Southern Sinai are thus apparently due to fracture in three directions. The district is, in fact, the meeting-point of two great longitudinal rift-systems, parallel to the Gulf of Suez and Gulf of Akaba respectively, traversed by a third or transverse type, the result being the apparently intricate maze of sharp crest and deep valley characteristic of this region.

Dr. Sven Hedin.—Dr. Friederichsen communicates to *Globus* (July 11, 1901) the substance of a letter from Dr. Sven Hedin, received at Stockholm early in June, which gives some information as to the traveller's movements during the past winter and his plans for the present summer. Dr. Hedin, who wrote on April 14 from Charklik, near Lob Nor, was in the best of health, and had lately returned from a successful expedition to the Gobi, which had lasted four months. He reports still further discoveries of cities and temples along the shores of the old Lob Nor, as well as of a number of Chinese manuscripts. For the journey across Tibet to India which he was about to undertake, Dr. Hedin had got together a caravan of twenty-seven camels and thirty-six horses and mules with the necessary supplies. He was also sending a separate caravan to Kashgar, and despatching thereby his extensive collections, including his maps, photographs, etc. Further information was also to be forwarded by means of this caravan.

Russian Expeditions in Central Asia.—It is announced from St. Petersburg that an expedition is to be despatched to the Pamirs by the Imperial Russian Geographical Society, under the leadership of the well-known traveller and scientist Dr. Fedshenko. The object of the expedition will be researches in the field of geology, botany, and zoology. We also learn that an expedition has this summer been sent by the same society to explore Lake Telezkoie, in the Altai. The preliminary results show that the northern part of the lake is not deeper than 30 fathoms, but that in the south depths of 150 fathoms, and probably more, exist. The temperature on the surface was found to vary from 37½° to 39° Fahr., while at 125 fathoms it fell to 25·3° Fahr.

A Siberian Mammoth.—An expedition has proceeded this summer to Siberia to bring to St. Petersburg the skeleton of a mammoth lately discovered in an unusually good state of preservation. Not only are the hair, skin, and flesh still intact, but remains of undigested food have been found in the stomach. The find was made in the neighbourhood of Kolymsk, in north-east Siberia, and the expedition arrived at Yakutsk, *en route* for that remote settlement, on June 14 last.

Recent Geology of Northern and Central Asia.—In the May number of the *Quarterly Journal of the Geological Society* there is a short paper by Prof. G. F. Wright on recent geological changes in Northern and Central Asia, as deduced from the results of researches carried out by him in 1900. Being familiar with the glacial phenomena of North America, and in a less degree of Europe, Prof. Wright planned his journey with a view to searching for similar evidence

* The author speaks of the valleys, not as due to rifts, but as themselves rifts, which seems to imply a much smaller width in proportion to the height of the sides than is found in the African rift-valleys.

of past glaciation in the parts of Asia which might be supposed to present the greatest analogies with the other northern continents in this respect. In this, the main object of his journey, he was unsuccessful, no traces of extensive past glaciation being met with in Japan, Mongolia, Manchuria, Eastern Siberia, or Russian Turkestan, all of which were in turn visited. In Mongolia the route led over the great loess region, and while allowing the important part played by the wind in the deposition of the loess, Prof. Wright holds that there are features in its distribution which seem unmistakably due to water action. In the region of the Sungari, which was next visited, the point which attracted most attention was the sluggish drainage which characterizes all the streams, the troughs of which are very old, and show a recent depression resulting in an extensive filling up of the channels. The recent origin of Lake Baikal is inferred from the fact that it has not been filled by the sediment due to the extensive erosion carried out by the Selenga and other rivers. In Turkestan the loess deposits, lying on exactly the opposite side of the central plateau to those of China, again attracted attention, and in Prof. Wright's opinion can only be explained by supposing a widespread submergence of the region to the extent of 3000 feet. Other facts which are supposed to point in the same direction are also adduced, among them being the small degree of salinity of Lake Balkash and other waters of the region, which is held to indicate very recent physical changes. The absence of continental glaciers in Asia is attributed partly to the permanent climatic conditions which render so much of Asia a comparatively dry region, and partly to a lower elevation as compared with America.

Marine Fauna of Peter the Great Bay.—In a preliminary report of his work in the Sea of Japan (*Izvestiya of the Imp. Russ. Geogr. Soc.*, vol. xxxvi., No. 5) M. Schmidt states that the fauna of Peter the Great bay is composed of two elements—namely, of forms found in the Sea of Japan as far south as Nagasaki and Fusan, and occasionally occurring even further south, and, secondly, of northern forms which, apparently, here reach their extreme southern limit, and have their centre of distribution in the Sea of Okhotsk. To the former class belong species of *Sebastes*, *Belone*, *Tetrodon*, *Gadus*, and varieties of mackerel; to the second, numerous representatives of the Cottidæ family, the genus Centridermichthus being particularly rich in species, and of the Blenniidæ, flat-fish, herring, smelts, and species of Agonus and Siphagonus. Among crustaceans, the southern forms *Portunus japonicus*, *Gebia major*, *Dorippe sp.* and *Pisa sp.* live side by side with the huge *Lithodes kamchatica*, which is not found further south, but occurs in the Sea of Okhotsk. Apparently the southern fauna predominates, but this will be determined when the whole collection of specimens has been examined. The fauna of Broughton bay on the coast of Korea, in which M. Schmidt also travelled, is very similar. Southern forms are only very slightly more numerous, while the northern species do not, in most cases, roam so far. M. Schmidt proposes to make himself acquainted with the fauna in more southern bays of the Korean coast, in the main Kuro-Shivo current, and between Vladivostok and the mouth of the Amur, so as to be able to institute a comparison, which will, he believes, throw some light on the existence of a cold current from the Sea of Okhotsk.

The East Coast of Korea.—Leaving for a time his biological work in the Sea of Japan, M. Schmidt made in 1900 (*Izvestiya*, vol. xxxvi. No. 5) a journey along the road from Wönsan to Fusan, a route probably followed only by M. Karneyef, who has not published an account of his journey. The road connects a series of small towns, of which the first, Ambun, was reached the day after the departure from Wönsan. It stands at a distance from the sea at the foot of a ridge of no great

height, which runs out from the main chain perpendicularly to the coast. Following this ridge M. Schmidt reached the shore, and for three days travelled through the same kind of country—plains covered with rice-fields, which are irrigated by streams descending from the mountains, and are sometimes interrupted by low spurs. There are several lagoons communicating with the sea by channels, some of which, as for instance the Suchumde, are of considerable size; others, and these the more numerous, are cut off from the sea by sandbanks, apparently of recent formation. From the Chogu-chen-dogu bay M. Schmidt made an excursion into the Almaz-inya (Diamond) mountains, crossing the watershed from the valley of the Uonjong to that of the Han, and returning by the Ammude-koge pass to the town Kosŏng on the coast. A few days later a companion, Dr. Lange, left him at Kansŏng to make his way to Sŏul by the little-known route past the town Inje. The country to the south being uninteresting, consisting as before of rice-fields and lagoons, M. Schmidt turned inland from Kannin and crossed the main drain by the high and difficult Tegulieng pass, descending to the river Kwanmul in the Han basin, and thence reaching the road from Soŭl to Fusan. The map of the Japanese General Staff, at any rate as translated by Colonel Laterner, shows here many errors. From Chaugnima the traveller journeyed to the Chun-yon-che pass placed in the Japanese map beside the mountain Chun-yan-san (in the Russian copy, entitled Popof). The natives, however, give this name to all the neighbouring mountains collectively, and the highest peak in the neighbourhood they call Sansanbong or Tasilno. This M. Schmidt ascended to a height of 4600 feet, as shown by an aneroid, and estimated that the summit rose only 300 to 350 feet above him. He then crossed the Chun-yon-che pass and proceeded to Fusan.

AFRICA.

Baron Erlanger and Herr Neumann in Southern Abyssinia.—The information supplied by Herr Neumann to the *Verhandlungen* of the Berlin Geographical Society (*Journal*, vol. xvii. p. 528) is supplemented by a letter from Baron Erlanger, published in the same periodical (1901, p. 240), and accompanied by a sketch-map, which, though making no claim to exactitude, throws light on the complicated lake-system of Southern Abyssinia. It seems that the two travellers journeyed separately, though by the same route, from Adis Abeba to Lake Abbaya, beyond which they took nearly opposite directions. After passing the south-west end of Lake Zuai, the islands of which were visited *en route*, Baron Erlanger passed southward between Lakes Afjadda (Hora of Wellby) and Langano, a newly discovered lake lying east of the former, and discharging to it (as does Zuai by the Suksuk) by a stream named Daka. Langano has a very irregular outline, and it could not therefore be mapped with precision. North of it lies Mount Aluto, on the north-east side of which another lake was reported by the natives. Leaving on the west the shallow lake Shahalla, which seems to be the Lamina of Wellby, the expedition reached Lake Abassi, which, like Shahalla, was reported by M. Darragon in 1897, though but vaguely shown on his map. In the dry season it forms two basins connected by a channel, but in the rains it overflows and forms a single large lake. The march round its north-east end led through primeval forests traversed by swampy streams and occasionally broken by mountain spurs running down to the lake. Count Erlanger failed to obtain permission from the Abyssinian chief to proceed direct to Lake Abbaya (Pagade of Bòttego), but was obliged to ascend the high plateau to the south, on which forests of junipers were seen. At Aberash, or Abera, the expedition was well received by the chief Balkha, who had under him an army of over two thousand Abyssinians. Proceeding to Lake Abbaya, the count followed its eastern shore

and traversed the mountainous neck of land which separates it from Gangyule (Abbaya of Donaldson Smith). He says that both the inflowing stream from the northern Abbaya and the outlet to the Sagan have underground courses, a fact which explains the uncertainty which has prevailed as to whether the Sagan were really an emissary of the lake. A circuit was made round the west of Gangyule, after which the Sagan valley was visited, and a return to the north-east effected by a route over the highlands intermediate between Bòttego's and Darragon's. From Abera the route was continued to the north-east, the loss of the baggage-animals by sickness being made good by porters supplied by the Abyssinian authorities. On the headwaters of the Jub the itinerary of Bòttego's first expedition was struck, and at Ginea, in the upper basin of the Webi, that of Dr. Donaldson Smith in 1894. The Baron hoped to return to the south and reach Lake Rudolf by a new route. News from Herr Neumann is also given at p. 325 of the *Verhandlungen*. After separating from Baron Erlanger, he had, with difficulty, made his way across the Omo to Kaffa and Jimma. Thence he started to survey the middle of the three principal branches of the Sobat, which, according to the latest news, he had already accomplished, having reached Fashoda before June 15 after a successful journey.

Explorations in the Kamerun.—The issues of the *Deutsches Kolonialblatt* for April 1 and 15 last contain accounts of journeys by Captain Ramsay and Herr von Puttkamer in the north-western interior of the Kamerun, which have opened up some previously unvisited districts. Captain Ramsay's route led north from the town of Kamerun (to be known henceforth, as is announced elsewhere in the *Kolonialblatt*, as "Duala," in order to distinguish it from the Kamerun territory) by the Mungo river and the Bali road to Manyeme, in about 5° 20′ N., whence it lay north-west as far as Nsakpe, near the rapids of the Cross river. During this part of the journey the course of the Aja, an important but hitherto unmapped tributary of the Cross river, was traced. In the neighbourhood of the British frontier Captain Ramsay executed a careful survey, and found that in the rainy season the so-called Ethiope rapids were not to be seen.* A British gunboat has, in fact, passed some distance above them to near Nsanakang, important as a trade centre and from the abundance of brine springs in its neighbourhood. The Aja, at a point one or two days' journey above its junction with the Mangu or Cross, was 70 to 80 yards wide, with steep banks clothed in dense forest. The further route led north-east, across the Mangu, through a difficult region of forests and mountains previously unvisited by white men. The water-parting between the Cross and the Biya, a tributary of the Benue, was crossed, and the expedition pushed to a point some 50 to 60 miles north of Bali before turning southward to that town, the importance of which as a trade centre has, Captain Ramsay thinks, been over-estimated. Herr von Puttkamer's outward route led north from the Rio del Rey to the Cross river, but the return was effected by Captain Ramsay's route, which can be followed on the sketch-map accompanying the second report.

POLAR REGIONS.

Bear Island.—When Prof. Nathorst landed on Bear island in 1898, he proposed to Mr. Gunnar Andersson, who accompanied him, that he should return the following year to make a more thorough examination. This suggestion was carried out, and in June, 1899, Mr. Andersson, accompanied by Messrs. Forsberg &

* Captain Becroft, in his attempt to ascend the river in the *Ethiope* (1842), was stopped, not by obstructions in the channel, but by the extreme violence of the current, due to the narrowing of the river.

Swenander, landed on the shore of a bay at the mouth of the Russian river, which they named Russian harbour. The scientific results of the visit are described in *Ymer*, No. 4, 1900. According to Mr. Andersson, the Burgomaster Gate could not be found in 1898. In the following year it was found that the arch had fallen in since Nordenskiöld's visit in 1864, but the rock was identified by the iron pin inserted for tide-measurements. Mr. Andersson agrees with Sir Martin Conway, that Poole's Mount Maleperdus (named during his voyage in 1605: see Purchas' *Pilgrimes*) is identical with the Mount Misery of modern maps, but asserts that Poole's Mount Misery is not Mount Hamberg, but is some point on the south-eastern coast. The cartographical work of the party was confined to a survey of Russian harbour and a general verification of Prof. Nathorst's map, which proved to be very accurate. A closer examination of the topography revealed a number of trough-like faults in the southern mountainous part of the island, running north and south. One starts from South harbour, another lies between Russian river and Mount Misery, and a third forms a valley called by Mr. Andersson Ymersdal, between the Hamberg and Antarctic mountains. In these cases the less compact Carboniferous, Devonian, and more recent Heklahok slates have sunk down between the harder rocks of the older Heklahok series. Two-thirds of the island are occupied by a low plain with innumerable small pools, terminated along the coast by a recently abraded edge 80 to 100 feet high, and rising to more than 300 feet north of Oswald's point and the western peak of Mount Misery. All indications seem to show that it is due to abrasion, which still continues to act along the coasts. The direction of the glacial striæ points to a movement of the ice from west to east, and erratic blocks confirm their evidence. No rocks of a kind not present *in situ* on the island have been found. De Geer has lately suggested that the glaciation of East Spitsbergen may have extended to Bear island, but that all traces of it have been erased by subsequent local glaciation. Prof. Nathorst found no trace of a post-glacial elevation of the land, and no strand ridges or terraces mark a higher water-level, so that apparently between two regions of elevation, northern Norway and Spitsbergen, there is a tract where no elevation has taken place in any post-glacial period. But here again it must be remembered that abrasion may have removed all signs of such movements. In the interior mud streams have done much to change the surface. In early summer, when the valley bottoms are free of snow, the drifts still remain on the slopes in a melting condition, and the water from them permeates through the detritus immediately below them until at length these sodden masses begin to move downwards into the valleys. Like glaciers, they shoot out narrow tongues, and also have terminal moraines. One such stream north of the Ella lake had a breadth of 115 feet, and a depth of fully 68 feet. Its terminal moraine, consisting of sandstone flags tilted up on end, was 56 feet broad. To these Swenander attributes in great measure the sterility of the island; the phanerogams, which, with the exception of *Kœnigia islandica*, are perennials, being easily swept away by the mud streams. A new find for Bear island was *Fusulina* limestone, an interesting type of the Carboniferous system. In a position between Scandinavia and Spitsbergen a mingling of arctic forms of life with those of lower latitudes might be expected. But, apart from birds, the fauna, as well as the flora, is exceedingly scanty. The only permanent mammals are foxes, besides which polar bears come over the drift-ice in winter. Among the birds some have a southern distribution, as the razorbill, which breeds on the Scandinavian coasts, and the common guillemot. Of the arctic puffin there are two varieties, of which the southern is very common on Bear island, while only one specimen of the northern (var. *glacialis*) was observed. A variety of charr peculiar to the island, caught in

the Ella lake, has been named by Dr. Lönberg *Salmo umbla*, var. *salvelino-insularis*. The fish is particularly interesting, because it resembles the more southern *Salmo umbla salvelinus* rather than the *Salmo umbla stagnalis* of Spitsbergen and Greenland. The poverty of the flora is shown by the fact that, while 125 species have been found on Spitsbergen, only 45 occur on Bear island. These, however, include the southern forms *Rhodiola rosea* and *Salix herbacea*, which do not grow in Spitsbergen. The meteorological observations supplement those taken by the whaling skipper Sievert Tobiesen, who wintered on Bear island in 1865-66. The mean for the year is 23·2° Fahr.; for the months October to April, 15·3°; May to September, 34·2°; and June to August, 37·6°. The yearly mean is 2·3° higher than that at Cape Thordsen, Spitsbergen, and other values differ in the same direction.

The Baldwin Arctic Expedition.—A telegram from Tromsö, dated July 17, announced the departure for the north, on the previous day, of the polar expedition under Prof. Baldwin, which has been equipped through the munificence of Mr. W. Ziegler, of New York. The expedition consists of two steamers, the *America* and *Esquimaux*, formerly belonging to the Dundee whaling fleet, and the *Fridtjof*, a Norwegian sailing vessel, which will not, however, proceed beyond Franz Josef Land.

The Spitsbergen Degree Measurement.—Once more the Russian and Swedish parties for the measurement of a degree on Spitsbergen have sailed to the scene of their labours, which will, it is hoped, be brought to a close during the present season. The Russians, with MM. Chernycheff and Backlund at their head, will have at their disposal, as we learn from *Petermanns Mitteilungen*, the three ships *Bakan*, *Ledokol*, and *Rurik*, while the Swedish expedition, under Prof. de Geer, has proceeded to its destination in the *Antarctic*, the ship in which Dr. Otto Nordenskiöld will afterwards sail for the Antarctic. The *Yermak* ice-breaker has also proceeded to Spitsbergen, to give any aid that may be required to the Russian party. It will afterwards sail for Novaya Zemlya, in order to investigate the possibility of finding a better route to Siberia round the north island than through the narrow passages further south.

Baron Toll's Arctic Expedition.—News from Baron Toll has been received by the St. Petersburg Academy of Sciences, stating that the expedition had safely arrived in the Gulf of Taimyr, and was wintering there. Colonel Shokalsky, who sends us the information, states that the Taimyr peninsula was reached on October 13, 1900 (old style), when an unbroken ice-barrier was encountered. The winter quarters were established in 76° 8′ N., 95° 6′ E. The coasts of the peninsula had been surveyed, and zoological, magnetic, and meteorological observations taken. The Nordenskiöld islands had been explored by Lieut. Matthiessen, who had been appointed commander of the *Zarya*, while Lieut. Kolomeitzeff had been sent to establish a coaling-station at Dudinskoe, on the Yenesei. Baron Toll hoped, himself, to make his way across the Cheliuskin peninsula in company with Lieut. Kolchak. The despatch was received by way of Yeneseisk, and was dated April 16.

Premiums Offered for News of Andrée.—We learn from *Petermanns Mitteilungen* (1901, No. 6) that premiums have been offered by Consul N. Persson, of Helsingfors, for each buoy thrown out by Andrée during his balloon voyage which may be found before the end of 1905 and forwarded to the Geographical Society at Stockholm. The amount offered is 500 kroner (£27) for each buoy containing intelligence, and 200 kroner (£11) for those without such intelligence, or for other objects belonging to the expedition. Consul Persson showed his interest in the expedition at the outset by bearing the expense of the preparation of the buoys, which have since proved their value as a means of conveying information.

The Peary Auxiliary Expedition, 1901.—Another steamer has this year been chartered by the Peary Arctic Club for the purpose of re-opening communication with the explorer, and taking up supplies for use in case the latter should be detained another winter in the north. The vessel is the *Erik*, formerly owned by the Hudson's Bay Company, but now the property of Captain Farquhar, of Halifax, N.S., a competent ice-master, with many years' experience of the waters between Halifax, Newfoundland, and Labrador. It is hoped that the *Erik* may bring home the gallant explorer, from whom nothing has been heard since March 31, 1900, at which date he was at Fort Conger, about to start on his final dash for the pole. Mrs. Peary and her daughter, who were taken up last summer by the *Windward*, and who have probably wintered at Peary's headquarters, may also be passengers, unless they have set out homewards before the arrival of the *Erik*, as may also Messrs. Stein and Warmbath of the Ellesmere Exploring Expedition, who were taken up by the *Diana* in 1899. The *Erik* left Sydney, C.B., on July 14, and would, if all went well, proceed direct to Peary's station at Etah, North Greenland.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Meteorology of the Upper Atmosphere.—Dr. Hann contributes to the *Geographische Zeitschrift* an admirable review of the monumental treatise on "Scientific Ballooning," published in three volumes by the Berlin Aeronautical Society, under the editorship of Drs. R. Assmann and A. Berson. Dr. Hann's review is really an article on the advances in knowledge of the upper strata of the atmosphere made during the last ten years as the result of the balloon ascents of the Berlin Society, and the experiments with *ballons sondes* and kites of M. Teisserenc de Bort and Mr. Lawrence Rotch. The subjects dealt with more particularly are air-temperature and its variations, aqueous vapour, wind, and atmospheric electricity. Although the results cannot be adequately summarized here, their interest and importance to meteorological science can scarcely be over-estimated, especially in their relation to existing theories of atmospheric circulation. The agreement of the extended observations with conclusions arrived at from theoretical considerations must be regarded as extremely satisfactory.

A Contribution to the Geography of Snow.—In a paper printed in No. 35 of *Leopoldina*, which, though dated 1899, has only recently been received, Prof. Paul Wagner concludes a series of investigations on the snow-covering in the mountains of Central Bavaria, based on observations carried out by the forest officers by order of the Bavarian Government. Besides giving a brief account of the last winter (1898–1899) for which the observations were made, the author presents an instructive summary of the conclusions to be based on the whole results obtained, and their general application in relation to the geography of snow. He points out first how the methods to be pursued by the geographer and agriculturist differ from those applicable to meteorology, the important point to the former being not so much the amount of the snowfall as the distribution in time of the snow-covering. In his tables he therefore shows both the number of days in each month in which such a covering exists and the average monthly and daily thickness of the snow-layer. Whereas January comes out as the month with the greatest number of days with snow on the ground, as regards the mean thickness of the covering the maximum occurs in February, thus showing that in the second half of the winter conservation plays a more important part than production. Prof. Wagner shows by a curve the average variation of the snow-layer during the winter for a series of years, bringing out in a striking way the gradual increase in thickness to the maximum in the middle of February, and

the sudden disappearance of the snow after the second third of March. This applies generally to the central highlands of Germany. Prof. Wagner also gives curves illustrating the influence of altitude and aspect on the depth and duration of the snow-layer, from which it is seen that, as might be expected, altitude has a direct influence on the depth of the covering. The aspect of the slopes plays, however, only a subordinate part in the formation of the snow-layer, though of much importance (as is also the angle of slope) in respect of its conservation. This is well shown by the increasing divergence of the curves for the different slopes, at equal elevations, as spring approaches. The last part of the paper deals with the effect of the melting of the snow on the level of the rivers, and their use for the transport of timber. The following points are emphasized: (1) The thicker the layer, and the more porous the snow, the longer is the water retained; (2) rapid floods occur only in the second half of the winter when the ground has become saturated. (3) At the first thaw rain probably has a greater effect than sunshine, as it helps to fill the interstices both in the snow and the soil. As regards the influence of forest, it is noted that a thaw accompanied by rain proceeds more rapidly in the forest than in the open, while the reverse is the case during sunshine.

A Seventeenth-century Globe.—The St. Petersburg Academy of Sciences has lately installed at Tsarskoe-selo the large globe, weighing some 3½ tons, constructed in the seventeenth century for Duke Frederick of Holstein, under the superintendence of Olearius, the celebrated astronomer and traveller, who was at the time the Duke's librarian. The globe, which is described in Marco Vincenzo Coronelli's 'Epitome Cosmografica' (Cologne, 1693), and, in recent times, by the late Prof. Fiorini in his 'Erd- und Himmelsgloben' (Leipzig, p. 83), was the work of Andreas Busch, a mechanician of Limburg. Its construction occupied from 1656 to 1674, and on completion it was placed in the Castle of Gottorp, from which fact it became known as the "Gottorp globe." The Earth is represented on the exterior, and the heavens on the interior, to which access is given by a door, a platform providing standing room for twelve persons. The globe has a diameter of 11 feet, and rotates on its axis, but is permanently adjusted to the latitude of 54½° N. It was acquired by Peter the Great and brought to Russia in 1713, being presented to the Academy in 1725. Up to the present it has remained in the Zoological Museum.

A-symmetrical River-deltas.—Prof. R. A. Daly puts forward in *Science* (June 14, 1901) a suggested explanation of the marked a-symmetry of certain river-deltas (especially that of the Mississippi), which is associated with a strong deflection (to the left in the case of that river) of the current near the mouth. He points out that the supposed influence, in the case alluded to, of the clock-wise movement of the Gulf Stream has been proved to miss the mark as an explanation, the prevailing direction of current movement being really westward, past the mouth of the river. The effect of this current on the form of the delta is traced in detail thus. Outside the river-bars aggradation of the sea-floor is progressing more rapidly on the west than on the east, and apart from the direct effect of this, the deeper water on the east is held to facilitate the yearly advance of the bars on that side. Again, the effect of the current on the bars may be supposed to weaken the latter at the left-hand extremity, where its impact is first felt, but to strengthen them on the right by the deposition of sediment. The river current of the flood season will thus break through the bar at its left-hand end, and there will be year by year a transference of the river-axis towards the left. Prof. Daly gives diagrams of the deltas of the Rhone and Ebro, showing how the same conditions are reproduced in the case of these, owing again to special conditions which cause a departure from the usual

scheme of deflection. He also refers to the deflecting action exercised by the Earth's rotation, which, as it happens, is in all three cases in the same sense as the influence attributed by him to the current. Observation is, he says, needed in order to test the theory in a set of cases where the action of the Earth's rotation would be in a contrary sense to that of the prevailing current.

GENERAL.

Distribution and Products of the Cork Oak.—An almost exhaustive monograph on the subject of the cork oak forms the concluding number for 1900 of the *Abhandlungen* of the Vienna Geographical Society. The author is Herr Eugen Müller, who has brought together from a wide literature a detailed account of the tree and its products from a botanical, geographical, and commercial point of view. The distribution of the tree is discussed both in reference to the general conditions of the soil, climate, etc., in which it flourishes, and to the regional distribution within the producing countries. Its habitat is limited to South-West Europe and North-West Africa, or roughly by the parallels of 45° and 34° N. and the meridians of 10° W. and 16° E. The tree thrives best on hill and mountain slopes of moderate elevation, for, though it ascends to an altitude of 4250 feet in Algeria and nearly 4000 feet in Spain, it is most plentiful in the former between 650 feet and 2600 feet, and in the latter between 1400 feet and 2000 feet. It thrives best in siliceous soil, and though preferring loose earth, it grows well on a rocky sub-soil. A mild climate, especially in winter, is a necessity, but of the two species (*Quercus suber* and *Q. occidentalis*) the former requires a clearer atmosphere, greater warmth, and a more sunny aspect, while the latter thrives on the vapour-clad shores of the Atlantic. A fairly high rainfall is indispensable, especially in winter, but in less degree in spring and autumn also. In north Africa, woods of cork oaks occupy the greatest extent in Algeria, and here they increase regularly from west to east in accordance with the increase in rainfall. In Europe Spain possesses the greatest area of cork woods, the tree being spread, more or less, over the whole country. The finest woods that exist occur in Catalonia, especially in the province of Gerona, which accounts for a third of all the Spanish cork woods. The tree is also distributed all over Portugal, but is limited to the south of France, the hill slopes of Lower Provence being especially productive, though the tree flourishes likewise on the sandy plains of Gascony and on the northern slopes of the Pyrenees. In Italy the cork woods have suffered much from the long prevalent forest destruction. Although known to and used by the ancients, the first traces of systematic cultivation date from the second half of the eighteenth century, the impulse in this direction being due to a German settler in the province of Gerona. In North Africa the modern extension of cultivation is the outcome of the French occupation of Algeria and Tunis. At the present time Portugal is the greatest producing country as regards quantity exported, but the value of that exported by Spain is considerably higher, owing to its better quality. Of importing countries, Great Britain takes a decided lead. The imports have steadily risen until they now stand at an annual amount of nearly 30,000 tons, with a value exceeding £900,000. The greater part is in the raw form, being used for the manufacture of linoleum.

The First Globe containing the name America.—A note in *Globus* (vol. 79, p. 307) gives, on the authority of a paper in the *Bulletin* of the Academy of Sciences at Cracau, an account of an early globe which is preserved in the Jagellon Library of the University of that city. The globe, which has been described for the first time in the publication referred to by Dr. T. Estreicher, forms part of a clock, dating from the opening years of the sixteenth century, and is made of

sheet copper. Its diameter is 29 inches. From a study of the geographical data displayed and the manner of its execution, Dr. Estreicher is of opinion that the globe must have been made between 1509 and 1511. It shows a remarkable similarity to the well-known "Hunt-Lenox" globe of New York, especially in the delineation and nomenclature of South America. In both the name "Terra Sanctæ Crucis," disused after 1511, appears in conjunction with the appellation "Mundus Novus," and both show a large island south of India and East of the southern point of Africa. This was taken by de Costa, in his description of the Lenox globe, to be an indication of Australia, but on the Cracau globe it bears the interesting inscription "America Noviter Reperta." Its east coast shows resemblances to that of South America, and the maker would thus appear to have drawn the latter continent twice over, in different places and with different names. This shows, in Dr. Estreicher's opinion, that the date of the globe must be very little after 1507, the year in which Waldseemüller bestowed the name America on the New World, the application of the name having not yet become fully established. The Cracau globe is, except the Lenox globe, the first known Post-Columbian globe, and is quite the first to show any part of the New World, to divide the same from Asia, and to apply to it the name America. Possibly, even, it may be the earliest cartographical document to contain that name. It is interesting to find, in regard to the delineation of the island above alluded to, an ambiguity parallel to that which attaches to the voyage of Gonneville; and it seems not impossible that imperfect information as to this voyage may have had something to do with the curious error on the globe.

The Livingstone Exhibition.—This exhibition, which was held at the Westminster Town Hall from June 18 to 21, under the presidency of the Right Hon. Sir George Taubman Goldie, and in connection with which Sir Clements and Lady Markham held a reception of Fellows of the Royal Geographical Society and their friends, is one among many indications of the importance of the health question to all who go abroad. Whether an expedition is contemplated to the south pole or to Central Africa, success to a considerable extent depends on the wise selection of suitable articles of outfit, and attention to the general precautions of a hygienic character, which are suggested by modern scientific research. This is the explanation of the exhibits of food and clothing, camp equipment and the like, which were on view at the Livingstone Exhibition, and of the lectures on the preservation of health which were delivered at the same time. The rapid strides which have been made in recent years in the manufacture of hygienic clothing, especially suitable to travellers, and the improved methods of preparing food products which may be kept for long periods of time and under adverse circumstances, without risk of decomposition, are matters which were illustrated in a practical way in the Westminster Town Hall, besides the innumerable devices which render the work of the modern explorer so much more easy than was the case at the beginning of the last century. Sir George Goldie pointed out in his opening speech that the exhibition was likely to have a more far-reaching result than could be obtained during the few days in which it was being held, and drew special attention to the Travellers' Health Bureau, in connection with which the exhibition had been organized, which has its offices at 133, Salisbury Square, E.C., and which exists for the purpose of collecting and disseminating information concerning the health problems of unhealthy, and particularly of tropical, climates. The Royal Geographical Society has already expressed its interest in the Bureau, not only by giving its support to the Livingstone Exhibition, but by appointing the secretary of the Bureau to be an instructor under the Society in the subjects of health and outfit. It may be mentioned that the Travellers' Health Bureau is a department of Livingstone College. The latter has

existed for the past eight years for the purpose of giving instruction to missionaries in the elements of medicine and surgery, and the new premises of the college, which were opened recently by Mrs. Bruce and other members of the Livingstone family on May 23 (*ante*, p. 94), is intended to be a permanent memorial in London to the work of Dr. Livingstone. It was for this reason that the name of Livingstone was given to the exhibition, the interest of which was enhanced by the unique collection of articles connected with Dr. Livingstone's life and work, particularly since the great explorer's daughter, Mrs. Wilson, and her husband attended each day and explained the various relics which were on view. The name of Livingstone has been happily associated with these various undertakings, seeing that he was a man universally respected, even by many who would have differed from him on certain points, and it is hoped that the Travellers' Health Bureau, with its quarterly journal *Climate*, which deals with climatic and hygienic problems from a practical point of view, may prove of service to the widely different classes of people who represent the British Empire in all parts of the world.

OBITUARY.

Admiral Sir A. H. Hoskins, G.C.B.

The Society has lost a distinguished member in the person of Admiral Sir Anthony Hoskins, who died at Pleystowe, Capel, near Dorking, on June 21 last. A son of the Rev. H. Hoskins, of North Perrot, Somerset, Sir A. Hoskins was born in 1828, and received his early education at Winchester, but entered the navy in 1842. He saw service both in East and South Africa and in China, taking part, among various actions, in the taking of the Taku forts and Tientsin in 1858. He became captain in 1863, and continued to rise rapidly in his profession, holding important commands on various stations abroad, besides doing good service at home for some years as a Lord of the Admiralty. In March, 1889, he obtained the coveted command of the Mediterranean fleet, returning home, however, in 1891 to become first naval Lord of the Admiralty, which office he held till his retirement in 1893. He had joined our Society in 1861, and served on its Council from 1897 to 1900, latterly as Vice-President.

Sir Cuthbert Peek.

We regret to announce the death, at the comparatively early age of 46, of Sir Cuthbert E. Peek, well known as a patron of scientific work, and, at our Society especially, for his active furtherance of the cause of geography. The deceased baronet joined the Society in 1875, served for a number of years on the Council of the R.G.S., and had been one of its trustees since 1895, having succeeded the late Lord Aberdare in that capacity. For the encouragement of geographical science he had, as is well known, founded an annual premium to be awarded by the Society in recognition of useful work done in the field of geography. As a traveller he was best known for his journeys in Iceland, in company with Mr. John Coles, an account of which appeared in the *Proceedings R.G.S.* for 1882. He was also much interested in astronomy and meteorology, and the useful work carried on for a number of years at his observatory at Rousden, in Devonshire, is well known to scientific men. He married, in 1884, the eldest daughter of Viscount Midleton, and leaves a numerous family.

Alexander Forrest.

The death occurred in June of Alexander Forrest, the younger of the two brothers whose names are indissolubly connected with the exploration of Western Australia. The first great expedition in which the two brothers, John and Alexander, were associated, was that undertaken in 1870, for the first time since the celebrated journey of Eyre in the opposite direction, round the head of the Great Australian Bight, the younger brother taking part in the capacity of surveyor. This expedition, which traversed the whole distance from Perth to Adelaide, led to the discovery of pastoral country within the inhospitable zone described by Eyre, in the vicinity of the coast. In 1871 Alexander Forest undertook a new expedition in search of pastoral country in the neighbourhood of Lake Lefroy, and in 1874 again accompanied his brother on the great expedition across the interior of Western Australia, which led from the headwaters of the Murchison to the Peak Telegraph Station. This expedition, in which all the difficulties inherent in such an undertaking were successfully overcome, though pack-horses were the only transport animals employed, was described in the 45th volume of the Society's *Journal*, as well as in a work afterwards published by Sir John Forrest. The younger brother continued to do good work as surveyor in Western Australia, and in 1879 led an expedition across the northern interior of the colony, discovering some of the finest pastoral country which is known to exist in that direction, as well as traces of minerals of value. Mr. Forrest joined our Society in 1872.

Edouard Foa.

The well-known French traveller, M. E. Foa (a Fellow of the Society since 1894), died on June 29 last, from an illness the germs of which, it is said, were contracted during his African journeys, as a result of the hardships still inseparable from travel in that continent. M. Foa first came into notice from his survey, with two companions, of the Whemi, the principal river of Dahome, which, until the date of the journey (1886–1889), had been practically unknown beyond a few miles from its mouth. The region of the Zambezi and Shire next attracted M. Foa's attention, and he spent several years from 1891 onwards in travelling over the little-known country between the Shire and Loangwa. After describing his adventures in two works entitled, 'A Travers l'Afrique Centrale,' 'Mes grandes chasses dans l'Afrique Centrale,' he returned to the same region, extending his explorations almost up to Bangweulu, and finally making his way to the West Coast *viâ* the Congo. The results of this journey were published only last year in a work entitled 'Du Zambèze au Congo.' Although, taken as a whole, M. Foa's journeys brought to light few geographical novelties of importance, he contributed his share to the filling in of details on our maps, and in particular did useful work in elucidating the ethnology of the countries in which he travelled.

Prof. Karl Zehden.

We regret to record the death, on May 22, of Dr. Karl Zehden, at the age of 58 years. Born at Linz in 1845, Karl Zehden studied under Sickel, Simony, and Lorenz von Hein, devoting himself specially to history, geography, and political economy. After travelling extensively in Europe and America, he was, in 1871, appointed professor of commercial geography at the Handels-Akademie, in Vienna, and in 1888 Inspector-General of technical instruction by the Department of Education. He received the title of Hofrath in 1895. Of his writings, the most important is his 'Lehrbuch der Handelsgeographie,' which has been translated into most European languages; but his great work lay in organizing and extending technical education, and his loss will be severely felt in Austrian educational circles.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1900–1901.

Thirteenth Ordinary Meeting, June 24, 1901.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Daniel Elie Anderson, M.B., B.Sc., B.A.; J. Mackintosh Bell, M.A.; Captain Chas. Wm. Brebner; Ernest Chappell; Ernest Danvers; Basil Howard Aleys Hankey; Major William Harrison, 3rd N. Lancs. Regiment; Henry Felix Hertz, C.I.E.; Alfred Henry Houlder; Thomas William How, C.E.; John Ince, M.D.; Lieut.-Colonel H. S. Massy, 19th Bengal Lancers; George H. Rogers; Thos. Langdale Marwood Rose; Major-General H. L. Smith Dorrien, D.S.O.; Robert C. Stevenson; William Munro Tapp; John Chas. Ponsonby Widdup, L.R.C.S.; Rhys Williams.*

The Paper read was:—

"The Belgian Antarctic Expedition." By Henryk Arctowski.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

THE following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Morphology. *Globus* **79** (1901): 203–205. **Jaeger.**
Die Salzburger Bucht. Von Julius Jaeger.

Austria—House-types. *Globus* **79** (1901): 220–224. **Tetzner.**
Das bosnische und herzegowinische Haus. Von Dr. F. Tetzner. *With Illustrations.*

Austria—Moravia. *Deutsche Rundschau G.* **23** (1901): 349–357. **Trampler.**
Das "Burgverlies" im mährischen Karst. Von R. Trampler. *With Plans.*
The Burgverlies is a cavern near the small village of Holstein, south-east of Sloup

Belgium and Holland. **Baedeker.**
Belgium and Holland, including the Grand Duchy of Luxembourg. Handbook for Travellers by K. Baedeker. Thirteenth Edition. With 14 maps and 22 plans. Leipsic: Karl Baedeker; London: Dulau & Co. 1901. Size 6½ × 4½, pp. lxvi. and 442. *Presented by Messrs. Dulau & Co.*

Carpathians. **Martonne.**
Contribution a l'Étude de la Période Glaciaire dans les Karpates méridionales. Par E. de Martonne. (Extrait du Bulletin de la Société Géologique de la France, 1900.) Size 10 × 6½, pp. 275–319. *Maps. Presented by the Author.*

The results of M. de Martonne's investigations are summarized in a note on p. 84, *ante*.

Denmark—Place-names. *G. Tidskrift* **15** (1900): 153–177; **16** (1901): 3–18. **Madsen.**
Udsigt over den geografiske Udbredelse af nogle i Danmark forekommende Stednavnsklasser. Af Oberst Emil Madsen.

On the distribution in Denmark of various types of place-names.

France. *Ann. G.* **10** (1901): 216–224. **Chantriot.**
La Thiérache. Par M. Émile Chantriot.

The Thiérache is a region of gently undulating plateaux on the borders of Champagne, Picardy, Hainaut, and the Belgian Ardennes.

France—Ardennes. **Arçtowski.**
Quelques mots relatifs a l'Étude du Relief de l'Ardenne et des directions que suivent les rivières dans cette contrée. Par Henryk Arçtowski. (Extrait du Bulletin de la Société Belge de Géologie, etc., Tome xi., 1897, pp. 118–127.) Bruxelles, 1901. Size 9½ × 6½. *Presented by the Author.*

France—Dunes. *Ann. G.* **10** (1901): 267–272. **Girardin.**
Les dunes de France. Par M. Paul Girardin.

France—Havre. *B.S.G. Com. Havre* **17** (1900): 193–218. **Hanotaux.**
Le Havre dans l'histoire de France. Par M. Gabriel Hanotaux.

France—Landes. *La G., B.S.G. Paris* (1900): 337–342, 463–483. **Hautreux.**
La côte des Landes de Gascogne. Par M. Hautreux. *With Diagrams and Maps.*

Deals principally with phenomena of the coast waters—currents, depths, temperatures, deposits, etc.

France—Roman Roads. *B.S.G. Lille* **35** (1901): 303–311. **Six.**
Coup d'œil sur le réseau des voies romaines de la région du Nord. Par Georges Six.

Germany—Bavaria. *Leopoldina* **35** (1899): 170–176. **Wagner**
Die Schneedecke im bayrischen Waldgebirge. Von Dr. Paul Wagner. *With Diagrams.*

This is referred to in the Monthly Record (*ante*, p. 218).

Germany—Harvests and Weather. **Meinardus.**
Einige Beziehungen zwischen der Witterung und den Ernte-Erträgen in Nord-Deutschland. Vortrag gehalten auf dem VII. Internationalen Geographen-Kongress in Berlin im Jahr 1899. Von Dr. Wilhelm Meinardus (Sonderabdruck aus den Verhandlungen des VII. Internationalen Geographen-Kongresses in Berlin, 1899.) Berlin, 1900. Size 10 × 6½, pp. 421–428. *Diagrams.*

Germany—Northern Plain. *Naturw. Wochenschrift* **16** (1901): 87–89. **Wahnschaffe.**
Prof. Dr. F. Wahnschaffe: Die Endmoränen des norddeutschen Flachlandes.

Germany—Waterways. *G.Z.* **7** (1901): 185–194. **Hochstetter.**
Die wasserwirtschaftliche Vorlage in Preussen. Von Dr. Wilhelm Hochstetter.

Greece. **Philippson.**
Beiträge zur Kenntnis der griechischen Inselwelt. Von Prof. Dr. Alfred Philippson (Dr. A. Petermanns Mitteilungen. Ergänzungsheft Nr. 134). Gotha: Justus Perthes, 1901. Size 11 × 7½, pp. iv. and 172. *Maps. Price* 10 *m.*

Greece. *B. American G.S.* **33** (1901): 31–35. **Richardson**
Akarnania and Ætolia. By Rufus B. Richardson.

Greece—Thessaly. **Merlin.**
Trade and Agriculture of Thessaly for the year 1900. Foreign Office, Annual No. 2557, 1901. Size 10 × 6½, pp. 18. *Price* 1½*d.*

Holland—Limburg. Loon.

Tijds. K. Ned. Aard. Genoots. Amsterdam **18** (1901): 394–406.

Steenkolen in Limburg. Door C. J. van Loon. *With Map.*

Hungary—Lake Balaton. ———.

Resultate der wissenschaftlichen Erforschung des Balatonsees . . . Herausgegeben von der Balatonsee-Commission der Ung. Geographischen Gesellschaft. Erster Band. Physische Geographie des Balatonsees und seiner Umgebung. Fünfter Theil. Physikalische Verhältnisse des Wassers des Balatonsees. I. Section. Temperatur-Verhältnisse des Balaton-Wassers. Von Dr. Johann Sáringer. Wien: E. Hölzel, 1901. Size 11½ × 8½, pp. 56. *Diagrams. Presented by the Hungarian Geographical Society.*

Iceland. *Petermanns M.* **47** (1901): 53–56. Thoroddsen.

Das Erdbeben in Island im Jahre 1896. Von Dr. Th. Thoroddsen. *With Map.*

Italy. *Atti Terzo Congresso G. Italiano, Firenze,* 1898 (vol. ii.): 11–21. Stefani.

Della necessità e del modo di determinare gli spostamenti del suolo in Italia. Relazione del Prof. Carlo de Stefani.

Suggestions for the investigation of earth-movements in Italy.

Italy—Florence. Badia.

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 570–577.

Pianta topografica della città di Firenze di Don Stefano Buonsignori dell' anno 1584—Memoria del Cav. Jodoco Del Badia. *With Plan.*

Italy—Glaciers. Porro.

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 130–133.

Notizie sui lavori della Commissione eletta dal Club Alpine per lo studio dei ghiacciai italiani. Comunicazione del Prof. Francesco Porro.

Italy—Gravity. Baglione.

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 33–46.

Sulle determinazioni relative di gravità terrestre eseguite in Italia e sulla opportunità di stabilire un programma cui uniformarsi nelle ulteriori determinazioni per gli scopi geodetici e geofisici.—Memoria del Capitano del Genio P. Baglione.

Italy—Lago d'Orta. Halbfass.

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 121–124.

Dati morfometrici sul lago d'Orta—Comunicazione del Dott. Guglielmo Halbfass.

Italy—Lakes. Agostini.

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 110–20.

Sullo stato attuale degli studi batometrici dei laghi italiani coll' aggiunta di un saggio per una bibliografia limnologica italiana.—Comunicazione del Dott. Giovanni De Agostini.

Italy—Linosa. Trabucco.

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 148–162.

L'isola di Linosa. Studio geo-fisico. Memoria del Prof. G. Trabucco. *With Maps and Illustrations.*

Linosa is the small volcanic island north of Lampedusa, between Sicily and the coast of Tunis.

Italy—Place-names. Pullè.

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 331–347.

Della opportunità di compilare un dizionario toponomastico dell' Italia, sulla base principalmente della carta d'Italia dell' Istituto Geografico Militare; e del metodo e dei mezzi da impiegarsi all' uopo. Relazione del Prof. Fr. L. Pullè.

Italy—Place-names. Ricchieri.

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 642–654.

Saggi di correzione dei nomi locali nelle carte topografiche dell' Istituto Geografico Militare, per quanto riguarda la Sicilia Occidentale e Meridionale. Memoria del Prof. Giuseppe Ricchieri.

Italy—Rivers. *Atti Terzo Congresso G. Italiano, Firenze,* 1898 (vol. ii.): 25–32. Mori.

Sull' opportunità di procedere ad una nuova determinazione dell' area dei bacini fluviali dell' Italia e della lunghezza del percorso dei singoli fiumi. Relazioni di Attilio Mori.

Italy—River Changes. **Taramelli.**
Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 90–102.
Di alcune delle nostre valli epigenetiche. Memoria del Professore T. Taramelli.
On examples taken from various parts of Italy of alteration in the direction of valleys due to river-capture, etc.

Italy—River-names. **Cestaro.**
Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 632–641.
Antichi nomi dei fiumi di Romagna. Communicazione del Prof. F. P. Cestaro.

Italy—Sardinia. **Cossu.**
Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 198–205.
Una nuova ricerca antropogeografica sull' isola di Sardegna. Distribuzione della popolazione secondo la costituzione geologica del suolo. Comuncazione di Angelo Cossu.
On the influence of physical environment on the population in Sardinia.

Italy—Sicily. **Marinelli.**
Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 134–147.
Fenomeni analoghi a quelli carsici nei gessi della Sicilia. Memoria del Prof. Olinto Marinelli. *With Maps.*
On "karst"-like phenomena in the chalk formation of south-west Sicily.

Italy—Sicily. **Sinatra.**
Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 103–109.
Alcune modificazioni recenti della linea di costa nella Sicilia meridionale. Comunicazione del Dott. Francesco Sinatra.

Italy—Terminology. **Battisti.**
Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 348–360.
Intorno ad una raccolta di termini locali attinenti ai fenomeni fisici ed antropogeografici da iniziarsi nelle singole regioni dialettali d'Italia. Relazione del Dott. Cesare Battisti.

Italy—Triangulation. **Vitale.**
Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 47–72.
Sulla triangolazioni principale d'Italia. Memoria dell' Ingegnere Geografo L. Vitale. *With Map.*

Italy—Tuscany. **Mori.**
Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 578–631.
Come progredi la conoscenza geografica della Toscana nel secolo xix. (Contributo alla storia della Cartografia italiana.) Memoria di Attilio Mori.

Mediterranean—Pilot. ———
The Mediterranean Pilot. Vol. iv. Comprising the Archipelago, with the adjacent coasts of Greece and Turkey; including also the island of Crete or Candia. Third Edition, 1900. London: J. D. Potter, 1900. Size 9½ × 6, pp. xxviii. and 458. *Index Chart. Price 4s. Presented by the Hydrographer, Admiralty.*

Pyrenees. *G.Z.* **7** (1901): 220–222. **Früh.**
Das Vorland der Pyrenäen. Von Prof. Dr. J. Früh.

Russia. *Mém. Comité Géolog.* **13** (1900): pp. 212. **Wissotzki.**
Les Mines d'or du District de Kotchkar dans l'oural du midi. Par N. Wyssotzky. [In Russian.] *With Maps and Illustrations.*

Russia—Murman Coast. **Knipovich.**
B.A. Imp. Sci. St. Petersbourg **12** (1900): 419–469.
Revue sommaire des travaux de l'expédition pour l'étude scientifique et industrielle du Mourmane. Par N. Knipovitch. [In Russian.] *With Diagram.*

Russia—Odessa. **Smith.**
Agriculture of the Odessa District for the year 1900. Foreign Office, Annual No. 2548. 1901. Size 9½ × 6, pp. 14. *Price 1d.*

Slav Race. *Atti Terzo Congresso G. Italiano, Firenze*, 1898 (vol. ii.): 655–665. **Musoni.**
Dei progressi dello Slavismo e della necessità di seriamente studiarlo anche in Italia. Memoria del Prof. Francesco Musoni.

Spain. **Harrison.**

Trade of Spain for the year 1899. Foreign Office, Annual No. 2560, 1901. Size 10 × 6½, pp. 40. *Price* 2½*d.*

Spain—Viticulture. **Bosdari.**

I Vini Spagnuoli. Rapporto del conte Alessandro Bosdari. (B. Ministero Affari Esteri, April, 1901.) Roma, 1901. Size 9 × 6½, pp. 40.

Sweden. *Ymer* **21** (1901): 79–91. **Andersson.**

Ett bidrag till kännedomen om hästens förekomst i Sverige under stenåldern. Af Gunnar Andersson. *With Plates.*

On remains supposed to be those of the horse, and to date from the Stone age.

Sweden. ——

Svenska Turistföreningens Årsskrift för År 1901. Stockholm: Wahlström & Widstrand. Size 8½ × 5½, pp. viii. and 462. *Illustrations.*

A description of the features of interest in Sweden from a tourist's point of view.

Sweden—Ancient Maps. *Ymer* **21** (1901): 59–78. **Lönborg.**

Om de äldsta Kartorna öfver Sverige. Af Sven Lonborg. *With Map.*

Switzerland. ——

Aperçu des résultats provisoires du recensement fédéral de la population en 1900 comparés en partie avec les données fournies par des recensements antérieurs. Berne, 1901. Size 11½ × 8½, pp. 16.

Switzerland. ——

Résultats provisoires du recensement fédéral de la population du 1er décembre 1900. Total de la population par communes. (Population de résidence ordinaire et population présente lors du recensement.) Par le bureau de statistique du Département fédéral de l'Intérieur. Bern, 1901. Size 11½ × 9, pp. 32.

Turkey—Albania. **Baldacci.**

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 220–230.

L'Italia e la questione albanese. Comunicazione del Dott. Antonio Baldacci.

The writer emphasizes the importance of Italian interests in Albania.

United Kingdom—Meteorology. ——

Meteorological Observations at Stations of the Second Order for the year 1897. Edinburgh: John Menzies & Co., 1900. Size 12½ × 10, pp. xiv. and 182. *Map. Presented by the Meteorological Office.*

United Kingdom—Meteorology. ——

Report of the Meteorological Council for the year ending March 31, 1900, to the President and Council of the Royal Society. London: Eyre & Spottiswoode, 1900. Size 9½ × 6, pp. 158. *Map and Diagram. Price* 11½*d. Presented by the Meteorological Office.*

United Kingdom—Scotland. *T. Edinburgh Geolog. S.* **8** (1901): 116–162. **Cadell.**

The Geology of the Oil Shalefields of the Lothians. By Henry M. Cadell. *With Sections.*

United Kingdom—Scotland. *T. Edinburgh Geolog. S.* **8** (1901): 91–97. **Mackie.**

Some Notes on the Distribution of Erratics over Eastern Moray. By Dr. W. Mackie.

United Kingdom—Scotland. **Smith.**

The Buried or Drift-filled Channels and Glens, and the Post-Glacial Glens of Ayrshire. By John Smith. (Reprinted from *Annals of the Andersonian Naturalists' Society,* vol. ii. part ii.) Glasgow, 1900. Size 9 × 6, pp. 51–66. *Map. Presented by the Author.*

United Kingdom—Scotland. *Blackwood's Mag.* **169** (1901): 391–400. **Stuart.**

In Hebridean Waters. By Hamish Stuart.

United Kingdom—Scotland. *Quarry* **6** (1901): 215–220, 283–288. ——

The Mineral Industry of the United Kingdom, Wigtown and Kirkcudbright. *With Map and Illustrations.*

United Kingdom—Silchester. *Archæologia* **57** (1900): 87–112. **Hope and Fox.**

Excavations on the site of the Roman city at Silchester, Hants, in 1899. By W. H. St. John Hope and George E. Fox. *With Plans and Illustrations.*

ASIA.

Armenia. **Lynch.**

Armenia, Travels and Studies. By H. F. B. Lynch. 2 vols. Vol. i. The Russian Provinces. Vol. ii. The Turkish Provinces. London: Longmans & Co., 1901. Size 10 × 6½, pp. (vol. i.) xvi. and 470; (vol. ii.) xii. and 512. *Maps, Plans, and Illustrations. Price 42s. net. Presented by the Publishers.*

A review of this important work will be given.

Central Asia. *La G., B.S.G. Paris* **3** (1901): 394–397. **Grenard.**

Voyages en Asie centrale du capitaine H. H. P. Deasy (1896–1898). Par M. F. Grenard. *With Map.*

Central Asia, etc. **Obrucheff.**

Central Asia, Northern China and Nan-Shan. Report of Journeys carried out under the orders of the Imperial Russian Geographical Society in 1892–94, by Mining-Engineer V. A. Obrucheff. Vol. ii. Route Journals relating to Central Mongolia, Dzungaria, and the mountain systems of the Be-shan, Nan-Shan, Eastern Tian-Shan and Tzin-lin-Shan. [In Russian.] St. Petersburg, 1901. Size 12 × 9, pp. xxvi. and 686. *Maps and Plates. Presented by the Imperial Russian Geographical Society.*

Central Asia—Sea of Aral. *Globus* **79** (1901): 213–215. **Seidlitz.**

L. S. Bergs Erforschung des Aralsees im Sommer 1900. Von N. V. Seidlitz.

This is referred to in the Monthly Record (*ante*, p. 86).

Ceylon—Cinnamon. **Hartwich.**

Vierteljahrs. Naturforsch. Ges. Zürich **45** (1900): 199–204.

Ueber den Ceylon-Zimmt. Von C. Hartwich.

China. *B. Comité l'Asie Française* **1** (1901): 28–36. **Bidou.**

La pénétration russe en Chine. Par M. Henry Bidou. *With Map.*

China. **Parsons.**

An American Engineer in China. By Wm. Barclay Parsons. New York: McClure, Phillips & Co., 1900. Size 8 × 5½, pp. 322. *Illustrations. Presented by the Author.*

An interesting study of Chinese questions, especially in reference to industrial development, based on a journey across Hunan for railway survey purposes in 1898–99. Although the conclusions were to a large extent formed before the recent troubles began, they still hold good in great measure, and the book may be recommended as offering a clear insight into the factors of the Chinese problem.

China—Singan-fu. **Obrucheff.**

The new capital of China and the routes to it from the shores of the Yellow Sea. By V. A. Obrucheff. [In Russian.] Size 10 × 6½. *Map.*

Chinese Empire—Gobi. *Petermanns M.* **47** (1901): 90–94. **Krahmer.**

Nachrichten von der Expedition P. K. Koslows. Von Gen. Krahmer.

An outline of Kozloff's expedition was given in the *Journal* for March (p. 303).

Dutch East Indies. **Van der Chijs.**

Nederlandsch-Indisch Plakaatboek, 1602–1811. Door Mr. J. A. Van der Chijs. Zeventiende Deel. Batavia, 1900. Size 8½ × 5½, pp. xliv. and 736.

A classified list of the documents contained in the previous sixteen volumes, with an alphabetical index to subjects.

Eastern Asia. **Hitchcock.**

Our trade with Japan, China, and Hongkong, 1889–1899. By Frank H. Hitchcock. (U.S. Department of Agriculture. Section of Foreign Markets. Bulletin No. 18.) Washington, 1900. Size 9 × 6, pp. 168.

French Indo-China. *B.S.G. Com. Paris* **23** (1901): 28–39. **Barthélemy.**

Un voyage chez les Moïs Stiengs, vivant au pied de la chaîne du Djambra. Par le C^te^ P. de Barthélemy. *With Map.*

French Indo-China—Annam. *B.S.G. Com. Paris* **22** (1900): 258 *bis*—270 *bis*. **Hauser.**

L'Annam central et la colonisation. Par M. Félix Hauser.

French Indo-China—Tonkin. *Rev. G.* **48** (1901): 283–299. **Massieu.**

Les territoires militaires du Tonkin. Par M^me^ Isabelle Massieu.

India.

List of Proceedings, etc., India, 1859–1898. Preserved in the Record Department of the India Office, London. London: Printed by Eyre & Spottiswoode, 1900. Size 13 × 8½, pp. 128.

India—Assam.

Returns of the Rail and River-borne Trade of the Province of Assam for the quarter ending March 31, 1900. Shillong, 1900. Size 13½ × 8½, pp. 130.

India—Forestry. *Nature* **63** (1901): 597–601. **Brandis.**

Indian Forestry. By Sir Dietrich Brandis, F.R.S.

India—Kashmir. **Donsen.**

Tijds. K. Ned. Aard. Genoots. Amsterdam **18** (1901): 416–462.

Klein-Tibet. Door M. Donsen.

India—Kolar Goldfield. *Mem. Geolog. Surv. India* **33** (1901): 1–18. **Hatch.**

The Kolar Goldfield, being a description of Quartz-Mining and Gold-Recovery as practised in India. By F. H. Hatch, PH.D. *With Map, Plan, and Plates.*

India—Madras. *J.S. Arts* **49** (1901): 469–488. **Rees.**

Madras, the Southern Satrapy. By J. D. Rees.

Indian Ocean—Seychelles. **Murat.**

Gordon's Eden; or, the Seychelles Archipelago. By M. Murat. Mauritius, 1900. Size 7½ × 5, pp. 26.

A short sketch of the geography, trade, and history of the Seychelles.

Japan—Formosa. **Kenny.**

Trade of Tainan for the year 1899. Foreign Office, Annual No. 2544, 1901. Size 9½ × 6, pp. 28. *Price* 2*d.*

Malay Archipelago—Bali. **Schwartz.**

Tijds. Indische Taal-, Land- en Volkenk. **43** (1900): 108–131.

Dagverhaal van eene reis van den resident van Bali en Lombok, vergezeld van den controleur voor de politieke aangelegenheden en de poenggawa's Ida Njoman Bandjar en Goesti Njoman Raka naar Karangasem en Kloengkoeng van 11 t/m 26 April 1898. *Map.*

Rapport van de Reis van den controleur Schwartz naar Bangli. *Map.*

Malay Archipelago—Bali.

Tijds. Indische Taal-, Land- en Volkenk. **43** (1900): 132–158.

Dagverhaal van eene reis van den resident van Bali en Lombok vergezeld van den controleur voor de politieke aanrakingen en de poenggawa's Ida Bagoes Gelgel en Goesti Ktoet Djlantik naar Tabanan en Badoeng, van 17 Juli t/m 5 Augustus 1899. *With Map and Table.*

Malay Archipelago—Borneo. **Molengraaf.**

Borneo-Expeditie. Geologische Verkenningstochten in Centraal-Borneo (1893–94). Door Dr. G. A. F. Molengraaff. With Atlas. Leiden: E. J. Brill, 1900. Size 11½ × 7½, Atlas, 19½ × 13½, pp. xxii., 530, and 56. *Maps and Illustrations.*

Malay Archipelago—Borneo. **Nieuwenhuis.**

In Centraal Borneo. Reis van Pontianak naar Samarinda door Dr. A. W. Nieuwenhuis. 2 vols. Leiden: E. J. Brill, 1900. Size 10 × 7, pp. (vol. i.) viii. and 308; (vol. ii.) viii. and 370. *Illustrations. Price* 30*s.*

These important works will be specially noticed.

Malay Archipelago—Borneo. **Nieuwenhuis.**

Tijds. K. Ned. Aard. Genoots. Amsterdam **18** (1901): 383–393.

Mededeelingen over eene Commissie-reis naar Centraal-Borneo. Door Dr. A. W. Nieuwenhuis.

Malay Archipelago—Java. **Brandes.**

Tijds. Indische Taal-, Land- en Volkenk. **43** (1900): 1–35.

Van oud-Batavia, losse mededeelingen (eerste reeks). Door Dr. J. Brandes.

Continuation of a previous article.

Malay Archipelago—Sumatra. *Die Natur* **50** (1901): 86–90. **Philippi.**

Eine Schöpfung deutscher Elektrotechniker im Urwald von Sumatra. Nach einem Aufsatze von Ober-Ingenieur Philippi. *With Illustrations.*

An account of the installation of electricity, generated by water-power, at the gold-mines of Rejang Lebong.

Persia—Historical. *J.R. Asiatic S.* (1901): 281-290. **Le Strange.**

The Cities of Kirmān in the time of Hamd-Allah Mustawfi and Marco Polo. By Guy le Strange.

Philippine Islands. **Walsh.**

Science in the Philippines. A review by James J. Walsh, PH.D. [New York, 1901.] Size 10 × 7, pp. 14. *Illustrations.*

Review of the account of the Philippines compiled by the Jesuits at Manila, and recently issued by the Government press at Washington.

Portuguese Colonies. *Questions Dipl. et Colon.* **11** (1901): 471-477. **Hauser.**

Colonies portugaises d'Extrême-Orient. Par Henri Hauser.

Russia—Caucasia. *Rev. G.* **48** (1901): 300-315, 370-396. **Baye.**

Chez les Tatars; de Derbent à Élisabethpol. Souvenirs d'une mission. Par Baron de Baye. *With Illustrations.*

Turkey. **Percy.**

Highlands of Asiatic Turkey. By Earl Percy, M.P. London: E. Arnold, 1901. Size 9 × 6, pp. x. and 332. *Maps and Illustrations. Price* 14*s. net. Presented by the Publisher.*

This will be specially noticed.

Turkey—Rhodes. *Petermanns M.* **47** (1901): 59-61. **Philippson.**

Geologie von Rhodus. Von Prof. Dr. A. Philippson.

AFRICA.

Algeria. **Randall-Maciver and Wilkin.**

Libyan Notes. By David Randall-Maciver and Anthony Wilkin. London: Macmillan & Co., 1901. Size 13 × 10, pp. viii. and 114. *Illustrations. Price* 20*s. net.*

This volume gives the results of archæological researches in Algeria carried out in 1900 with a view to throwing light on the question of the early connection between the Berbers and Egyptians. The character of the country visited and the life and industries of the inhabitants are also described, and a large series of anthropometric *data* and photographs of native types supply matter of much value to the anthropologist. The general result of the investigation has been to show that Libya and Early Egypt were not united by any ties of race.

Algeria. *A travers le Monde, Tour de Monde* **7** (1901): 153-156. ——

Excursions aux gisements de phosphates de Tébessa. *With Map and Illustrations.*

Angola. *A travers le Monde, Tour du Monde* **7** (1901): 137-140. ——

Les Progrès de la Colonie portugaise d'Angola. *With Map and Illustrations.*

British South Africa—Southern Rhodesia. ——

British South Africa Company. Information for Intending Settlers in Southern Rhodesia. 1901. Size 8½ × 5½, pp. 38. *Illustrations. Presented by the British South Africa Company.*

Central Africa. **Moore.**

To the Mountains of the Moon. Being an account of the modern aspect of Central Africa, and of some little-known regions traversed by the Tanganyika Expedition, in 1899 and 1900. By J. E. S. Moore. London: Hurst & Blackett, 1901. Size 9 × 6½, pp. xvi. and 350. *Maps and Illustrations. Price* 21*s. net. Presented by the Author.*

This will be noticed among reviews of African books.

Comoro Islands. **Repiquet.**

Le Sultanat d'Anjouan (Iles Comores). Par Jules Repiquet. Paris: A. Challamel, 1901. Size 8 × 5½, pp. 138. *Map and Illustrations. Price* 2*s.* 8*d.*

A systematic account of the geography, ethnology, and history of the island of Johanna.

Congo—Rubber. *B.S. d'Études Colon.* **8** (1901): 256-266. **Wildeman.**

Quelles sont les plantes qui produisent les divers caoutchoucs du Congo. Par E. de Wildeman.

Egypt. **Alban.**

Trade of Egypt for the year 1899 and half of 1900. Foreign Office. Annual No. 2549, 1901. Size 9½ × 6, pp. 44. *Price* 2½*d.*

Egypt. **Grenfell, Hunt, and Hogarth.**

Egypt Exploration Fund: Græco-Roman Branch. Fayûm Towns and their Papyri. By Bernard P. Grenfell, Arthur S. Hunt, and David G. Hogarth. With a Chapter by J. Grafton Milne. London: Offices of the Egypt Exploration Fund, etc., 1900. Size 10½ × 8, pp. xvi. and 374. *Map and Plates. Presented by D. G. Hogarth, Esq.*

Part i. gives a valuable sketch of the ancient geography of the Fayum, followed by an account of the discovery of papyri throwing light on the past history of the region. Part ii. deals with the results of recent excavations, while in Part iii. the documents are described and their text reproduced.

Egypt. **Beadnell.**

Recent Geological Discoveries in the Nile Valley and Libyan Desert. By Hugh J. L. Beadnell. (An English translation of a paper communicated to the International Congress, Paris, 1900.) Size 8½ × 5½, pp. 24. *Map. Presented by the Author.*

This is the complete version of the paper of which an abstract was noticed in the *Journal*, vol. xvii. p. 527.

Egypt. *Questions Dipl. et Colon.* **11** (1901): 451–470. **Brunhes.**

De quelques formes spéciales de la pénétration anglaise en Égypte. Par Jean Brunhes.

Deals with the extension of British influence through such means as the irrigation service, the schools, and the employment of capital.

Egypt—Arabian Desert. *B.S. Khédiv. G.* **5** (1900): 515–577. **Fourtau.**

Voyage dans la partie septentrionale du désert arabique. Par M. R. Fourtau. *With Map.*

The author's itineraries have supplied new matter for the cartography of the little-known plateaux of the Galala el Baharieh and Galala el Kiblieh, west of the gulf of Suez.

French Guinea. *B.S.G. de l'Est* **21** (1900): 407–423. **Courtet.**

En Casamance. Par E. Courtet. *With Map.*

French Sudan. *Rev. G.* **48** (1901): 255–282, 345–369. **Dornin.**

Dans le nord du Soudan français. Par Pierre Dornin. *With Maps and Illustrations.*

A well-illustrated account of a voyage up the Senegal and down the Niger to Timbuktu.

German East Africa. **Hollis.**

Report on German East Africa for the year 1900. Foreign Office, Annual No. 2568, 1901. Size 9½ × 6, pp. 50. *Price 3d.*

Gold Coast—Ashanti. **Biss.**

The Relief of Kumasi. By Captain Harold C. J. Biss. London: Methuen & Co., 1900. Size 8 × 5½, pp. xiv. and 316. *Map and Illustrations. Price 6s. Presented by the Publishers.*

A well-told narrative of the operations for the relief of Kumasi, from the writer's personal experience, supplemented from that of other officers. The introduction gives a summary of the recent history of British West Africa, while the map is reduced from that published by the Intelligence Division of the War Office.

Ivory Coast. *La G., B.S.G. Paris* **3** (1901): 311–315. **Clozel.**

Bingerville, la nouvelle capitale de la côte d'Ivoire. Par M. Clozel. *With Map and Plan.*

Kamerun. *Globus* **79** (1901): 133–135. **Hutter.**

Wirtschaftliche Bedeutung von Nordkamerun insbesondere der Hochlandsgebiete. Von Hauptmann Hutter.

Natal—Mines. ——

Colony of Natal. Supplement to the Report on the Mining Industry of Natal, 1899. Pietermaritzburg, 1900. Size 13 × 8.

Consists of illustrations of geological sections.

Nile and Zambezi. *J. R. Colonial I.* **32** (1901): 157–176. **Gibbons.**

The Nile and Zambezi Systems as Waterways. By Major A. St. Hill Gibbons.

The author goes more at length, than in the paper read before the Society, into the

possibilities of navigation on the Zambezi and Nile, and the commercial importance of their utilization.

North-East Africa. **Vannutelli.**

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. i.): 221–236.

Intorno all' ultima spedizione Bòttego. Conferenza del tenente di vascello Lamberto Vannutelli.

Portuguese East Africa. *Questions Dipl. et Colon.* **11** (1901): 83–103. **Hauser.**

Études sur les colonies portugaises.—III. Moçambique. Par Prof. H. Hauser. *Map.*

Sahara. **Honoré.**

Maurice Honoré. Le Transsaharien et la pénétration française en Afrique. Paris: A. Pedone, 1901. Size 9 × 6, pp. 144. *Map. Presented by the Author.*

A historical *resumé* of the question of the Trans-Saharan Railway Project, with a bibliography. The author is cautious in expressing an opinion as to the value of such a line.

Sahara. *La G., B.S.G. Paris* **3** (1901): 257–260. **Lapparent.**

La trouvaille d'un oursin fossille dans le Sahara. Par A. de Lapparent.

On the recent determination as belonging to the *Echinidæ* of a fossil (*Noetlingia Monteili*) found by Monteil near Bilma. The writer points out the importance of this discovery of the remains of a marine animal in connection with the geological history of the Sahara.

Sahara and Sudan. *B.S.G. Com. Paris* **23** (1901): 7–27. **Foureau.**

De l'Algérie au Congo français, par l'Aïr et le Tchad. Par F. Foureau. *Map.*

Spanish West Africa. *B.R.S.G. Madrid* **2** (1901): 12–18. **[Sobral.]**

Guinea española.—La crisis ne braceros.—Krumanes, Kukis y Pamues.—Fertilidad de los territorios españoles.—Explotación de sus riquezas.—Errores del fisco.

Tunis. *B.S.G. Marseille* **24** (1900): 373–383. **Causeret.**

Voyage en Tunisie, la colonisation, conférence de M. Ch. Causeret.

Tunis. *B.S.G. de l'Est* **21** (1900): 230–237, 377–406. **Saurin.**

L'invasion sicilienne et le peuplement français de la Tunisie. Par M. J. Saurin.

West Africa. **Kingsley.**

West African Studies. By Mary H. Kingsley. Second Edition, with additional chapters. London: Macmillan & Co., 1901. Size 8½ × 5½, pp. xxxii. and 508. *Portrait, Map, and Illustrations. Price 7s. 6d. Presented by the Publishers.*

A popular edition, similar to that previously issued of Miss Kingsley's 'Travels in West Africa.' The appendices to the original edition are omitted, and their place taken by various lectures and articles of a date subsequent to the first appearance of the book. The volume, though compact, is well printed, and the publishers have done good service in placing it within the reach of a wide circle of readers.

West Africa—Boundaries. *B.R.S.G. Madrid* **2** (1901): 7–11. ——

Africa española. Convenio especial celebrado entre España y Francia para la delimitación de las posesiones de ambos paises en el Africa Occidental.

NORTH AMERICA.

Alaska. **Abercrombie.**

Alaska. 1899. Copper River Exploring Expedition, Captain W. R. Abercrombie, commanding. Washington, 1900. Size 9½ × 6, pp. 170. *Map and Plates. Presented by the United States Government.*

This will be noticed with other works on Alaskan Exploration.

Alaska. **Elliot.**

Description of an apparently new species of Mountain Goat. By D. G. Elliot. (Field Columbian Museum, Publication 46. Zoological Series, vol. iii. No. 1.) Chicago, 1900. Size 9½ × 6½, pp. 6. *Illustrations.*

The head of this mountain goat was obtained from an Indian in Alaska in 1899.

Alaska. *National G. Mag.* **12** (1901): 180–196. **Gannett.**

The General Geography of Alaska. By Henry Gannett. *With Illustrations.*

Alaska. **Glenn and Abercrombie.**

Reports of Explorations in the Territory of Alaska (Cooks Inlet, Sushitna, Copper, and Tanana Rivers). 1898. Made under the direction of the Secretary of War

by Captain Edwin F. Glenn and Captain W. R. Abercrombie. July, 1899. Washington, 1899. Size 9 × 6, pp. 464. *Map. Presented by the United States Government.*

An account of the work of the two army expeditions of 1898.

Alaska. *Mazama* **2** (1901): 70–74. **Kincaid**

Harriman Alaska Expedition. By Trevor Kincaid. *With Illustrations.*

Alaska. ——

Compilation of Narratives of Explorations in Alaska. Washington, 1900. Size 12 × 9, pp. viii. and 856. *Maps and Illustrations. Presented by the United States Government.*

A valuable series of reports on exploring expeditions sent out to Alaska by the United States War Department, from 1869 (Raymond's expedition) to 1899.

Alaska—Cape Nome. *B.S.G. Com. Paris* **22** (1900): 320–331. **Schneider.**

Au Cap Nome. Par M. Schneider. *With Illustrations.*

Mexico—Cedros Island. *B. American G.S.* **33** (1901): 64–66. **Eisen**

Cerros, or Cedros Island. A Note by Gustav Eisen, PH.D.

The writer gives his verdict in favour of the form Cedros as the name of this island, discovered in 1539 by Francisco de Ulloa.

Mexico—Colonization. **San Marco.**

La Colonizzazione nel Messico. Le Colonie Agricole Italiane. Rapporto del conte Roberto di Villar San Marco. (B. Ministero Affari Esteri, Marzo, 1901.) Roma, 1901. Size 9 × 6½, pp. 20.

Mexico—Tacubaya Observatory. ——

Anuario del Observatorio Astronómico Nacional de Tacubaya para el Año de 1901. Año xxi. México, 1901. Size 7 × 5, pp. 362.

Mexico—Yucatan. **Peirce.**

Trade of Yucatan for the year 1900. Foreign Office, Annual No. 2556, 1901. Size 10 × 6, pp. 6. *Price* ½*d.*

Rocky Mountains. *Z. Ges. Erdk. Berlin* **36** (1901): 1–19. **Deckert.**

Die Hochketten des nordamerikanischen Felsengebirges und der Sierra Nevada. Von Dr. Emil Deckert. *With Plates.*

United States—Agricultural Imports. **Hitchcock.**

Sources of the Agricultural Imports of the United States, 1894–1898. By Frank H. Hitchcock. (U.S. Department of Agriculture. Section of Foreign Markets. Bulletin No. 17.) Washington, 1900. Size 9 × 6, pp. 118. *Presented by the U.S. Department of Agriculture.*

United States—Beet Sugar. **Wyndham.**

Beet Sugar Industry in the United States. Foreign Office, Miscellaneous No. 548, 1901. Size 10 × 6½, pp. 8. *Price* ½*d.*

United States—California. *P. California A. Sci., Geology* **1** (1900): 261–322. **Turner.**

The Pleistocene Geology of the South Central Sierra Nevada, with especial Reference to the Origin of Yosemite Valley. By Henry Ward Turner. *With Plates.*

United States—Coosa River. *B. American G.S.* **33** (1901): 67–72. **Bromberg.**

The Coosa River. By Frederick G. Bromberg.

The Coosa river took an important place early in the nineteenth century in schemes for an interior water-route between the Atlantic and the Gulf of Mexico.

United States—Irrigation. *B. American G.S.* **33** (1901): 73–80. **Brigham.**

Notes on the Recent Progress of Irrigation in the United States. By A. B. Brigham.

United States—New Jersey. **Harshberger.**
P.A. Nat. Sci. Philadelphia (1900): 623–671.

An Ecological Study of the New Jersey Strand Flora. By John W. Harshberger, PH.D.

United States—New Jersey. *P.A. Nat. Sci. Philadelphia* (1900): 544–549. **Saunders.**

The Pine Barrens of New Jersey. By C. F. Saunders.

United States—Pennsylvania. **MacElwee.**

P.A. Nat. Sci. Philadelphia (1900): 482–490.

The Flora of Edgehill Ridge near Willow Grove, and its Ecology. By Alexander MacElwee.

CENTRAL AND SOUTH AMERICA.

Argentine Republic. *B.S.G. Com. Paris* **22** (1900): 294–314. **Daireaux.**

Évolution économique et sociale de la République Argentine depuis dix ans. Par M. Émile Daireaux.

Argentine Republic. *Kolon. Z.* **2** (1901): 104–109. **Lhiez.**

Esperanza de Santa Fé, die erste Ackerbaukolonie Argentiniens. Von S. Lhiez. *With Illustrations.*

Argentine Republic—Provincial Boundaries.

B.A. Nac. Ci. Cordoba **16** (1900): 293–348.

Antecedentes y documentos de la demarcacion de limites entre las provincias de Córdoba y La Rioja. *With Plan.*

Bolivia—Cochabamba. **Haënke, Romero and Ballivian.**

Introduccion a la Historia natural de la Provincia de Cochabamba. Estudios inéditos del esplorador Don Tadeo Haënke. Compilados y anotados por B. D. Romero y J. A. Ballivian. La Paz, 1900. Size 8½ × 5½, pp. viii. and 118. *Presented by the Geographical Society of La Paz, Bolivia.*

Bolivia and Chile. **Valdés.**

Bolivia y Chile. Antecedentes históricos. Discusión Diplomática. Estado actual de la cuestión. Por J. C. Valdés. Santiago de Chile, 1900. Size 7 × 5, pp. viii. and 232.

A statement of facts bearing on the territorial question between Bolivia and Chile.

Brazil. **Branner.**

Results of the Branner-Agassiz Expedition to Brazil. IV. Two Characteristic Geologic Sections on North-East Coast of Brazil. By John C. Branner. (P. Washington A. Sci., vol. ii. pp. 185–201, August 20, 1900.) Washington, 1900. Size 10 × 7. *Maps and Illustrations.*

Brazil. **Branner.**

The Manganese Deposits of Bahia and Minas, Brazil. By Prof. John C. Branner. A Paper presented to the American Institute of Mining Engineers at its California Meeting, September, 1899. Author's Edition, 1899. Size 9 × 6, pp. 16. *Illustrations.*

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Ditto. Second Mémoire du Brésil. 6 vols. Vol. v. Facsimile de quelques documents reproduits aux Tomes ii., iii. et iv.—Vol. vi. Atlas. Berne: Stæmpli & Cie, 1899. (Vol. vi. Paris: A. Lahure.) Size 10½ × 7½; vol. v., 19 × 12½; vol. vi., 22½ × 16; pp. (vol. i.) xviii. and 232; (vol. ii.) xvi. and 528; (vol. iii.) xvi. and 402; (vol. iv.) xii. and 294. *Maps and Facsimiles. Presented by the Brazilian Government.*

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L'arbitrage anglo-vénézuélien de Guyane. Par M. G. Pariset.

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Ensayos sobre La Geología del Perú. Por J. Balta. Size 10 × 7, pp. 12. *Map. Presented by the Author.*

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South America: an Outline of its Physical Geography. By Colonel George Earl Church. (From the *Geogr. Journal* for April, 1901.) Size 10 × 6½, pp. 78. *Maps.*

South America. **Godio.**

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AUSTRALASIA AND PACIFIC ISLANDS.

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A Statistical Account of the Seven Colonies of Australasia, 1899–1900. By T. A. Coghlan. Eighth Issue. Sydney, 1900. Size 9 × 6, pp. 836. *Map.*

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The Federal Constitution of Australia. By Professor H. Macaulay Posnett, LL.D.

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Results of Meteorological Observations in New South Wales during 1898. By H. C. Russell, C.M.G., etc. Sydney, 1900. Size 9½ × 6½, pp. 72.

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Report on the Permo-Carboniferous Coal Measures of Clermont and associated formations. By B. Dunstan. Brisbane, 1900. 13½ × 8½, pp. 18. *Map and Plans.*

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La Religion païenne aux Îles Samoa, notes traduites par M. Jean Lavoix.

Solomon Islands. *Deutsch. Kolonialblatt* **12** (1900): 113–117. **Bennigsen.**

Ueber eine Reise nach den deutschen und englischen Salomons-Inseln. Von Gouverneur v. Bennigsen.

Tonga Islands. *J. B. Linnean S. (Botany)* **35** (1901): 20–65. **Burkill and Crosby.**

The Flora of Vavau, one of the Tonga Islands. By J. H. Burkill, with a short account of its vegetation. By C. S. Crosby.

Western Australia. *La G., B.S.G. Paris* **3** (1901): 279–286. **Garnier.**

L'ancien "désert Victoria" (Australie occidentale). Par Jules Garnier. *With Illustration.*

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Une excursion en Australie. Par M. H. Kuss.

Deals chiefly with the gold-fields of Western Australia.

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Expediţiunea Antarctică Belgiană. Conferinţă de Emil. G. Racoviţă, Naturalistul Expediţiunei. *With Map and Plates.*

Antarctic—Bellingshausen's Voyage. *B. American G.S.* **33** (1901): 36–41. **Cook.**

Captain Fabian Gottlieb von Bellingshausen, 1819–1821. The Discovery of Alexander I., Peter I., and other Islands. By F. A. Cook.

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The Work of the National Antarctic Expedition. By Prof. J. W. Gregory. *Map.*

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L'expédition du duc des Abruzzes au pôle Nord, en 1899–1900. Par G. N. *Map.*

Based on the addresses of the Duke and Captain Cagni at the Italian Geographical Society, and notes furnished by Prof. Grifoni.

Arctic—Andrée's Expedition. *Ymer* **21** (1901): 92–95. **Nathorst.**

Atgärder för tillvaratagande af föremål fraå Andrée-expiditionen. Af A. G. Nathorst.

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A Canadian Polar Expedition. By Captain J. E. Bernier.

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The Norwegian Polar Expedition, 1893–1896. By E. Plumstead. [Also separate copy, presented by the Author.]

An examination of the recently published 'Scientific Results' of the voyage in the direction of astronomical determination of position.

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Proposition d'Expeditions Polaires Arctiques, Internationales et Simultanées. Communication faite au VII[ème] Congrès International de Géographie à Berlin en 1899. Par E. Payart. Berlin, 1900. Size 10 × 6½, pp. [4].

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Greenland. *Öfversigt K. Vet. A. Förhand. Stockholm* **57** (1900): 763–787. **Åkerblom.**

Positions géographiques déterminées par des observations astronomiques faites pendant l'expédition suédoise au Grönland en 1899. Par Filip Åkerblom.

Dr. Åkerblom accompanied Dr. Nathorst in his expedition to East Greenland (*Journal*, vol. xvii. p. 48).

Spitsbergen. *Öfversigt K. Vet. A. Förhand. Stockholm* **57** (1900): 99–130. **Arnell.**

Beiträge zur Moosflora der Spitzbergischen Inselgruppe. Von H. W. Arnell.

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Mesure d'un arc de méridien au Spitzberg. Historique général et travaux des missions russes. Par O. Backlund. *With Map and Illustrations.*

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Relation des opérations de la mission russe pendant l'hiver 1899–1900 et l'été 1900. Résumé du rapport de M. Tchernychev.

Spitsbergen. **Carlheim-Gyllensköld.**

Öfversigt K. Vet. A. Förhand. Stockholm **57** (1900): 499–515.

Travaux de l'expedition suédoise au Spitzberg en 1898, pour la mesure d'un arc du méridien.

Full details of the geodetic operations in northern Spitzbergen in 1898.

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En exkursion för uppmätining af Van Wijens bay under 1898 års svenska polar-expedition. Af C. J. Otto Kjellström. *With Map.*

Van Mijen's bay is the Klok bay of Sir Martin Conway, the northern branch of Bell sound.

Spitsbergen. *La G., B.S.G. Paris* **3** (1901): 303–310. **Rabot.**

Résumé des travaux des missions suédoises pour la mesure d'un arc de méridien au Spitsberg. Par Charles Rabot.

MATHEMATICAL GEOGRAPHY.

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Cartography—Methods. **Cattolica.**

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. i.): 245–260.

Dei metodi seguiti dal R. Ufficio Idrografico nel disegno e nella riproduzione delle carte idrografiche. Conferenza del Comandante P. L. Cattolica. *With Charts, etc.*

Geodesy. *G. Tidskrift* **16** (1901): 18–30. **Engell.**

Om Bestemmelsen af Jordens Form og Størrelse. En historisk-geodætisk Oversigt. Af Dr. Phil. M. C. Engell.

Geodesy. *C. Rd.* **132** (1901): 597–599. **Hatt.**

Utilisation des points de Collins pour la détermination d'un quadrilatère. Note de M. Hatt.

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Ueber die allgemeinste Abbildung der geodätischen Kreise einer Fläche durch Berührungstransformationen. Von C. W. Oseen.

Globes. *Atti Terzo Congresso G. Italiano, Firenze*, 1898 (vol. ii.): 501–505. **Fiorini.**

Sfere terrestri e celesti di autore italiano, oppure in Italia fatte o conservate. Comunicazione del Prof. Matteo Fiorini.

Map projections. **Maes.**

Projection Sphérique comparée aux autres projections. Par Valère Maes. (Université Nouvelle, Institut Géographique de Bruxelles, Publication No. 4.) Bruxelles, 1901. Size 10 × 6½, pp. 14. *Illustrations.*

Mariner's Compass. **Botto.**

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 363–381.

Contributo agli studi storici sull' origine della bussola nautica. Memoria del Colonello del Genio Antonio Botto.

Nautical Almanac. ——

The Nautical Almanac and Astronomical Ephemeris for the year 1904. Also Part i. only (containing such portions as are essential for Navigation). London: Eyre & Spottiswoode. Size 9 × 6, pp. xiv., 638, and 18; Part i., xiv. and 310. *Diagrams. Price* 2*s.* 6*d.*; *Part I.*, 1*s. Presented by the Admiralty.*

Surveying—Methods. **Laussedat.**

Recherches sur les Instruments, les Méthodes et le dessin topographiques. Par le Colonel A. Laussedat. Tome ii., Première Partie. Iconométrie et Métrophotographie. Paris: Gauthier-Villars, 1901. Size 10 × 6½, pp. 198. *Maps and Plates.*

The first volume of this work appeared in 1898, and was noticed in the *Journal* for the following year (vol. xiii. p. 459). The present instalment deals with the various methods of obtaining maps and plans from pictorial views.

Use of Maps. **Sensini.**

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. i.): 271–315.

L'intelligenza della carte geografiche e topografiche è indispensabile per un buono insegnamento di geografia. Conferenza del Prof. Pietro Sensini. *With Maps.*

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Age of the Earth. *Geolog. Mag.* **8** (1901): 125–128. **Hunt.**

The Age of the Earth and the Sodium of the Sea. By Arthur R. Hunt.

The writer points to the possibility of sea-water being absorbed by the surface rocks of the globe as affecting the calculation of the age of the Earth recently made by Prof. Joly.

Auroras. *Öfversigt K. Vet. A. Förhand. Stockholm* **57** (1900): 545–580. **Arrhenius.**

Ueber die Ursache der Nordlichter. Af Svante Arrhenius.

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Otto Baschin. Die ersten Nordlichtphotographien aufgenommen in Bossekop (Lappland). (Sonder-Abdruck aus der Meteorologischen Zeitschrift, Wien, 1900, Band 17.) Size 11½ × 7, pp. [2]. *Plate.*

Caspian Sea. *Öfversigt K. Vet. A. Förhand. Stockholm* **57** (1900): 13–29. **Lönnberg.**

Contributions to the Biology of the Caspian Sea. By Dr. Einar Lönnberg.

Contains data as to the depth and temperature of the water at different stations.

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Versuch einer Klassifikation der Klimate, vorzugsweise nach ihren Beziehungen zur Pflanzenwelt. Von Dr. W. Köppen.

This is an abridged version of the article in the *Geographische Zeitschrift* for 1900, already noticed in the *Journal* (vol. xvii. p. 436).

Climate and Agriculture. *Monthly Weather Rev.* **29** (1901): 8–14. **Wren.**

Climate and Corn. By H. B. Wren.

Forest and Soil. *Petermanns M.* **47** (1901): 64–68. **Gravelius.**

Der Einfluss des Waldes auf Bodenfeuchtigkeit und Grundwasser. Von Prof. Dr. H. Gravelius.

Geological History. *Riv. G. Italiana* **8** (1901): 3–17, 81–88. **Bertelli.**

Studi intorno ad alcune ipotesi e teorie geogeniche. Del P. Timoteo Bertelli.

Geomorphology—Red Sea. **Issel.**

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 73–89.

Morfologia e genesi del Mar Rosso (saggio di paleogeografia). Memoria del Prof. Arturo Issel. *With Plate.*

Glaciers. **Richter.**

Commission Internationale des Glaciers. Les Variations Périodiques des glaciers. Cinquième rapport 1899. Rédigé par E. Richter. (Extrait des *Archives des Sciences physiques et naturelles*, t. x. 1900.) Genève, 1900. Size 9 × 6, pp. 20.

Limnology. *C. Rd.* **132** (1901): 1089–1091. **Forel.**

La variation thermique des eaux. Note de M. F. A. Forel.

On temperature observations in the Lake of Geneva.

Meteorology. *Petermanns M.* **47** (1901): 86–90. **Meinardus.**

Die Hauptergebnisse der wissenschaftlichen Ballonfahrten in Norddeutschland. Von W. Meinardus.

Review of the work of Assmann and Berson.

Meteorology. *P. American A. Arts and Sci.* **36** (1901): 307–318. **Clayton.**

The Eclipse Cyclone and the Diurnal Cyclones. Results of Meteorological Observations in the Solar Eclipse of May 28, 1900. By H. Helen Clayton. *With Diagrams.*

Meteorology. **Martonne.**

Un cas particulier de la Marche diurne de la température en haute montagne. Par E. de Martonne. (Extrait du Bulletin de la Société scientifique et médicale de l'ouest, 2e trimestre 1900.) Rennes. Size 10 × 6½, pp. 10.

Meteorology—Air-dust. *C. Rd.* **132** (1901): 1153–1155. **Bertainchand.**
Sur les poussières atmosphériques observées à Tunis le 10 mars 1901. Note de M. E. Bertainchand.

Natural Boundaries. **Viezzoli.**
Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 163–167.
I confini naturali nella coscienza popolare e nella scienza. Comunicazione del Prof. Francesco Viezzoli.

Oceanography. *Öfversigt K. Vet. A. Förhand. Stockholm* **57** (1900): 139–144. **Cleve.**
Geographical Distribution of Atlantic Copepoda and their Physical Conditions. By P. T. Cleve.

Oceanography. **Giglioli.**
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Dell' opportunità che siano riprese in Italia le osservazioni e gli studi talassografici. Relazione del Prof. Enrico H. Giglioli.

Oceanography. *B.S.G. Marseille* **24** (1900): 392–400. **Giraud.**
Les récents progrès de l'étude des mers. Par M. Hubert Giraud.

Oceanography. **Nordenskiöld.**
Öfversigt K. Vet. Förhand. Stockholm **57** (1900): 1115–1127.
Beiträge zur Kenntniss des Thierlebens in Wassersammlungen von wechselndem Salzgehalt. Von Erland Nordenskiöld. *With Illustration.*

Oceanography. *Rev. Maritime* **148** (1901): 685–703. **Thoulet.**
Conférence internationale de Stockholm pour l'étude de la mer. Par J. Thoulet. *With Maps.*

Oceanography. **Wagner.**
Zur Frage der Nomenklatur der Meeresraüme und der Geographischen Nomenklatur ueberhaupt. Vortag gehalten auf dem VII. Internationalen Geographen-Kongress in Berlin im Jahr 1899. Von Prof. Dr. Hermann Wagner. (Sonderabdruck aus den Verhandlungen des VII. Internationalen Geographen-Kongresses in Berlin, 1899.) Berlin, 1900. Size 10 × 7, pp. 370–378. *Presented by the Author.*

Oceanography—Methods. **Knudsen.**
Beretning fra Kommissionen for videnskabelig Undersøgelse af de danske Farvande. Andet Bind. Tredie Hefte. Maaling af Havvandets Temperatur og Saltholdig hed ved Hjaelp af elektrisk Telefonbro. Af Martin Knudsen. Kjøbenhavn, 1900. Size 14 × 10½, pp. 16. *Diagrams.*

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Jahrbuch der Astronomie und Geophysik. Enthaltend die wichtigsten Fortschritte auf den Gebieten der Astrophysik, Meteorologie und physikalischen Erdkunde . . . herausgegeben von Dr. Hermann J. Klein. XI. Jahrgang, 1900. Leipzig: E. H. Mayer, 1901. Size 9 × 6, pp. viii. and 380. *Plates.*

Terrestrial Magnetism. **Wagner.**
Peter Apians Bestimmung der magnetischen Missweisung v. J. 1532 und die Nürnberger Kompassmacher. Von Hermann Wagner. (Aus den Nachrichten der K. Gesellschaft der Wissenschaften zu Göttingen. Philologisch-historische Klasse. 1901. Heft 2.) Size 9½ × 7, pp. 12. *Presented by the Author.*
The special importance of this determination of magnetic declination lies in the fact that it is one of the few cases in the sixteenth century in which the exact year of the observation is known with some certainty.

Tides. *Nautical Mag.* **70** (1901): 183–188. **Plumstead.**
The New Theory of Tide. By E. Plumstead.

Volcanoes. *Die Natur* **50** (1901): 186–187, 193–196. **Pawloff and Chulok.**
Die Vulkane der Erde und die vulkanischen Erscheinungen im Weltall. Nach Prof. A. Pawloff von S. Tschulok.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Colonisation and Health. **Hueppe.**
Ueber die modernen Kolonisationsbestrebungen und die Anpassungsmöglichkeit der Europäer in den Tropen. Von Ferdinand Hueppe. (Sonderabdruck aus der

Berliner Klinischen Wochenschrift, 1901.) Berlin: A. Hirschwald, 1901. Size 9½ × 6, pp. 34. *Price* 1*s.*

The writer is not one of those who believe in the acclimatization of Europeans in the Tropics.

Commercial Geography—Cotton. **Charlier-Tabur.**

La G., B.S.G. Paris **3** (1901): 414–418.

La production du Coton dans le monde. Par M. V. Charlier-Tabur. *With Map.*

Commercial Geography.—Fishery. **Southwell.**

Notes on the Seal and Whale Fishery of 1900. By Thomas Southwell, F.Z.S. (From the *Zoologist*, March, 1901, pp. 81–90.) Size 8½ × 5½. *Presented by the Author.*

Commercial Geography—Indiarubber. **Jordan.**

Nicanor Jordán. Manual para la Extracción y Beneficio de la Goma Elastica. La Paz, 1900. Size 9 × 7, pp. iv. and 52. *Illustrations.*

Commercial Geography—Ramie. *Rev. G.* **48** (1901): 397–407. **Rivière.**

La ramie, son aire de végétation et son industrie. Par M. Ch. Rivière.

Commercial Geography—Telegraphs. ———

Submarine and Land Telegraph Systems of the World. [From the *Summary of Commerce and Finance* for January 1899.] Treasury Department, Bureau of Statistics. Size 12 × 9½, pp. 1655–1676.

Commercial Geography—Timber. *J.S. Arts* **49** (1901): 249–265. **Schlich.**

The Outlook of the World's Timber Supply. By Dr. W. Schlich.

This will be the subject of a note in the Monthly Record.

Ethnology—Bedawin. *B. Union G. Nord de la France* **21** (1900): 65–86. **Carton.**

Le Bédouin. Par le Docteur Carton.

Ethnology—Fins. *Ann. G.* **10** (1901): 140–147. **Zaborovski.**

Les Finnois. Par M. Zaborowski.

Ethnology—Turks. *B.A. Imp. Sci. St. Petersbourg* **13** (1900): 221–261. **Hirth.**

Sinologische Beiträge zur Geschichte der Türk-Völker. I. Die Ahnentafel Attila's nach Johannes von Thurócz. Von Friedrich Hirth.

Historical. **Callahan.**

American Relations in the Pacific and the Far East, 1784–1900. By James Morton Callahan, PH.D. (Johns Hopkins University Studies in Historical and Political Science. Series xix. Nos. 1–3.) Baltimore, 1901. Size 9½ × 6, pp. 178.

Historical. *Atti Terzo Congresso G. Italiano, Firenze*, 1898 (vol. i.): 125–149. **Marinelli.**

Discorso di chiusura del Terzo Congresso Geografico Italiano e di inaugurazione delle onoranze centenarie a Paolo Toscanelli e ad Amerigo Vespucci.

Historical. *Atti Terzo Congresso G. Italiano, Firenze*, 1898 (vol. ii.): 491–500. **Rossini.**

Vasco da Gama, Pedralvarez Cabral e Giovanni da Nova nella cronica di Kilwah. Memoria del Dott. Carlo Conti Rossini.

Historical—Azores. **Dalbertis.**

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 423–438.

Priorità dei Genovesi nella scoperta delle Azorre. Memoria del Capitano E. A. Dalbertis.

Historical—Map. **Casanova**

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 560–569.

Sopra uno schizzo cartografico originale della prima metà del XVI. secolo. Comunicazione del Dott. Eugenio Casanova. *With Plate.*

Historical—Map. **Magnaghi.**

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 506–513.

Il Mappamondo del genovese Angellinus de Dalorto (1325). (Contributo alla storia della Cartografia Mediovale.) Memoria del Prof. Alberto Magnaghi.

Prof. Magnaghi's preliminary account of this map was the subject of a note in the *Journal* in 1899 (vol. xiii. p. 203).

Historical—Map. **Rodolico.**

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 544–550.

Di una carta nautica di Giacomo Bertran maiorchino.—Comunicazione del Dott. Niccolò Rodolico.

Historical—Map and Globe. **Marzi.**

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 551–559.

Notizie intorno ad un mappamondo e ad un globo terrestre posseduto nel 1509 da Luigi Guicciardini. Memoria del Dott. Demetrio Marzi.

Historical—Münster. **Beazley.**

Sebastian Münster. By C. Raymond Beazley. (From the *Geographical Journal* for April, 1901.) Size 9½ × 6½, pp. 4.

Historical—Roggewein. *Nautical Mag.* **70** (1901): 164–173. **Gillie.**

Roggewein's Voyage for Discovery of Southern Lands. By J. Gillie.

Historical—Vespucci. **Uzielli.**

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 455–490.

Amerigo Vespucci davanti alla critica storica. Memoria del Prof. Gustavo Uzielli.

Migrations. *Földrajzi Közlemények* **27** (1899): 266–273. **Bartek.**

A népvándorlások inditóokai és czéljai, Bartek Lajostól.

On the causes and objects of tribal migrations.

Political Geography. *B.S.R.G. d'Anvers* **25** (1901): 45–82. **Alexis.**

Bilan géographique du XIX^e^ siècle. Par le frère Alexis M.-G.

A *résumé* of the political changes during the nineteenth century.

Prince Henry the Navigator. **Leclercq.**

Henri le Navigateur et l'Académie Portugaise de Sagres. Par le Dr. Jules Mees. Rapport de M. Jules Leclerq. (Extrait des Bulletins Acad. Royale de Belgique, No. 1, Janvier, 1901.) Size 9 × 6, pp. 6. *Presented by the Author.*

In the memoir here discussed, Dr. Mees endeavoured to prove that the association of experts in cosmography which Prince Henri is said to have gathered round him at Sagres, existed only in the imagination of historians.

BIOGRAPHY.

Bell. **Hallock.**

One of Canada's Explorers. By Charles Hallock. Washington: 1901. Size 8 × 5½, pp. 16. *Portrait. Presented by the Author.*

Dawson. *Science* **13** (1901): 561–563. **Adams.**

George M. Dawson. By Prof. Frank D. Adams. *With Portrait.*

GENERAL.

British Colonies—Education.

Special Reports on Educational Subjects. Vol. 4, Educational Systems of the Chief Colonies of the British Empire (Dominion of Canada, Newfoundland, West Indies) (pp. xxxii. and 834); vol. 5 (Cape Colony, Natal, Commonwealth of Australia, New Zealand, Ceylon, Malta), pp. xxvi. and 838. London: Eyre & Spottiswoode, 1901. Size 9½ × 6. *Price*, vol. 4, 4*s.* 8*d.*; vol. 5, 4*s.*

Congress.

Atti del Terzo Congresso Geografico Italiano tenuto in Firenze dal 12 al 17 Aprile, 1898, 2 vols. Firenze, 1899. Size 10 × 7, pp. (vol. i.) 320; (vol. ii.) 672. *Maps and Plates.*

Education. *J. School G.* **5** (1901): 129–133. **Blount.**

Exercises on United States Topographical Maps. By R. E. Blount.

The writer urges the importance of making students acquainted with the data on which geographical generalizations rest, and shows the value for this purpose of good topographical maps properly used.

Education. **Costantini.**

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 280–288.

Come la geografia, nell' insegnamento elementare, possa assumere una funzione efficacemente didattica ed altamente educativa. Relazione di G. C. Costantini.

The writer shows the great value of geography as an educational subject.

Education. **Ghisleri.**

Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. i.): 261–270.

Come s'insegni la geografia negli Stati Uniti d'America. Conferenza del Prof. Arcangelo Ghisleri.

Education—Maps. **Costantini.**
Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 289–293.
Le carte geografiche nelle scuole elementari: quali dovrebbero usari nei primi anni, quali negli anni successivi. Relazione di G. C. Costantini.

Education.—Methods. *G.Z.* 7 (1901): 195–206. **Sieger.**
Geographische und statistische methode im wirtschaftsgeographischen Unterricht. Von Prof. Dr. Sieger.

Education—Text Book. **Ghose.**
Easy Steps to Geography and Map-pointing. By R. N. Ghose. London and Glasgow: W. Collins, Sons, & Co., 1900. Size 7½ × 5, pp. 32. *Maps. Price* 4*d.* *Presented by the Author.*
This is merely a compilation on the old and discredited system, consisting mainly of lists of names.

Geographical Progress. ——
In Commemoration of the Reign of Her Late Majesty, Queen Victoria, Empress of India. (From the *Geographical Journal* for March, 1901.) Size 10 × 6½, pp. 28. *Portrait.*

Geology and Geography. **Porena.**
Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 315–327.
Della Convenienza e opportunità di rinforzare nella Geografia lo studio sulle forme del terreno dal punto di vista esteriore della plastica, e di renderne più precisa e stabile la nomenclatura. Relazione del Prof. Filippo Porena.
Treats of the mutual relations of geology and geography.

German Colonies. ——
Jahresbericht über die Entwickelung der Deutschen Schutzgebiete im Jahre 1899–1900. Berlin: E. S. Mittler und Sohn, 1901. Size 12 × 9, pp. 266.

German Colonies. ——
Weissbuch. Einundzwanzigster Theil. Berlin, 1901. Size 12½ × 9, pp. 266.
Gives full statistics of the trade, etc., of the German Colonies in 1899–1900.

Measures of Length. **Uzielli.**
Atti Terzo Congresso G. Italiano, Firenze, 1898 (vol. ii.): 382–400.
L'evoluzione delle misure lineari presso i vari popoli in tutti i tempi e specialmente nel medio evo in Firenze. Comunicazione del Prof. Gustavo Uzielli.

Science of Geography. *B.S.G. Lille* 35 (1901): 269–290. **Ardaillon.**
Les principes de la Géographie moderne. Par M. Ardaillon.
The writer traces the evolution of modern geographical science from the lists of names, formerly learnt by heart, through the descriptive geography of Reclus, to the present conception of the science as the study of man and his environment.

Transliteration. **Morris.**
Literation and Transliteration. Suggestions and Notes by Henry Morris. (Bible House Papers, No. v.) London: the British and Foreign Bible Society, 1901. Size 8½ × 5½, pp. 30. *Price* 6*d.*
Although devised for purposes of general transliteration, the alphabet here suggested might to some extent supply useful hints for geographical orthography. The basis is in harmony with the R.G.S. system, but some desirable distinctions, as between *a* in *hat* and the same letter in *amount*, are introduced.

Tropical Hygiene. *Church Missionary Intelligencer* 52 (1901): 370–374. **Lankester.**
Life and Work in the Tropics, and how to prepare for it. By Herbert Lankester, M.D.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**
ORDNANCE SURVEY OF ENGLAND AND WALES:—Revised sheets published by the Director-General of the Ordnance Survey, Southampton, from June 1 to 30, 1901.

1-inch:—

With hills in brown and black, 123 (engraved), 1*s.*; printed in colours, 8, 213, 1*s. each.*

Towns and country around or districts, with roads printed in colour, North Devon, 1*s.* 3*d. each.*

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25-inch—County Maps:—

Bedfordshire, VII. 10, 11, 13, 14, 16; VIII. 6, 12, 15; IX. 14; X. 3, 4, 7, 8, 12; XI. 2, 3, 4, 7, 8, 11; XII. 2, 3, 4, 5, 6, 7, 8; XIII. 1, 2, 5,* 6,* 9,* 10,* 13, 15; XVII. 15; XVIII. 3, 9, 14. **Cardiganshire,** I. 6, 7, 8, 12, 14; II. 5. **Derbyshire,** LIII. 15; LVII. 3, 7, 11, 15, 16; LVIII. 6. **Merionethshire,** XIX. 13; XXXII. 5, 15; XXXIII. 13, 16; XXXIV. 13; XXXVI. 11; XXXVII. 3, 4; XXXVIII. 1, 3, 4, 7, 11, 12, 13, 14, 15; XXXIX. 2, 5, 9, 10, 11; XLI. 11; XLII. 4, 9, 13; XLIII. 1, 2; XLVI. 4, 9, 10, 14; XLVIII. 1, 2, 3, 5, 6, 7, 8, 12; XLIX. 5. **Monmouthshire,** VI. 2, 11, 15; X. 4, 8; XI. 5, 8; XII. 10, 14, 15; XIII. 6, 7, 8; XVII. 2, 4, 12; XVIII. 3, 7, 8, 11, 16; XIX. 1, 3, 5, 8, 12, 13, 14; XXIII. 1, 8, 9, 13; XXIV. 1, 2, 4, 6, 7, 8, 9, 10, 11; XXVII. 11. **Montgomeryshire,** III. 16; IV. 3, 7, 8, 11; XII. 10, 11; XIX. 1, 2. **Shropshire,** I. 15, 16; II. 10, 15; III. 13; VII. 3, 11, 12; VIII. 7, 9, 11; IX. 1. **Staffordshire,** XXIII. 14; XXIV. 9, 14; XXIX. 1, 4, 5, 6, 7, 8, 11, 12; XXX. 3, 4, 5, 6, 7, 9, 10, 11, 13, 14, 15; XXXI. 1, 2, 5, 7, 8, 11, 12, 13, 14, 15; XXXII. 2, 9, 10, 13, 14; XXXIII. 15; XXXIX. 2. **Wiltshire,** XXXVIII. 11, 16; XLIV. 8, 11; L. 16; LI., 13, 15; LII. 13; LVI. 12; LVII. 1, 4, 5, 6, 7, 8, 10, 11, 12, 14, 15, 16; LVIII. 5, 9; LXIV. 5, 13; LXVI. 3, 4, 5, 6; LXVII. 5, 9, 15, 16; LXIX. 1, 15, 16; LXXI. 6, 7, 10, 11, 13; LXXVI. 2, 3. 3*s. each.*

* And Huntingdonshire (detached).

4 miles to 1 inch:—

7, 11, 12 (engraved). 1*s.* 6*d. each.*

County maps with road printed in colour:—Essex, Hampshire and Wiltshire, Lincolnshire, Surrey and Sussex, Wiltshire, and Hampshire. 1*s.* 6*d.*, or folded in cover, 1*s.* 9*d. each.*

Miscellaneous Map.

Roman Camp, Parish of Gelligaer, county of Glamorgan (Scale 1 : 500). 2*s.* 6*d.* (*E. Stanford, London Agent.*)

England and Wales. **Bartholomew.**

Reduced Ordnance Survey of England and Wales. Scale 1:126,720 or 2 stat. miles to an inch. Sheet: 27, Swansea. J. Bartholomew & Co., Edinburgh, 1901. *Price* 2*s. Presented by the Publishers.*

Europe. **Henkel.**

Verbreitung der Schriftarten in Europa um 1900. Von Dr. L. Henkel. Scale 1 : 25,000,000 or 393 stat. miles to an inch. *Petermanns Geographische Mitteilungen,* Jahrgang 1901, Tafel 6. Gotha: Justus Perthes, 1901. *Presented by the Publisher.*

Glasgow. **Johnston.**

International Exhibition Plan of Glasgow, showing principal public buildings, railway stations, tramways, and routes to and from the exhibition. Scale 850 feet to an inch. W. & A. K. Johnston, London, and Edinburgh and Glasgow. *Price* 6*d. Presented by the Publishers.*

There are, on this one sheet, a plan of Glasgow showing the site of the exhibition in red, and indicating the principal buildings, and streets, railways, and tramways, a

plan of exhibition buildings on an enlarged scale, and copious notes. It is certainly cheap for sixpence, and ought to prove very useful to those who are visiting Glasgow for the exhibition, or for the forthcoming meeting of the British Association.

Grecian Archipelago. **Philippson.**

Geologische Karte der Magnesischen Inseln und der Insel Skyros. Die Magnesischen Inseln und die Insel Skyros. Scale 1:300,000 or 4·8 stat. miles to an inch. Von Prof. Dr. A. Philippson. *Petermanns Geographische Mitteilungen*, Ergänzungsheft No. 134, Taf. 1 and 3. Gotha: Justus Perthes, 1901. *Presented by the Publishers.*

Grecian Archipelago. **Philippson.**

Karte der Kykladen. Geologische Karte der Kykladen. Scale 1 : 300,000 or 4·8 stat. miles to an inch. Von Prof. Dr. A. Philippson. *Petermanns Geographische Mitteilungen*, Ergänzungsheft No. 134, Taf. 2 and 4. Gotha: Justus Perthes, 1901. *Presented by the Publisher.*

Iceland. **Thoroddsen.**

Island. Scale 1 : 3,000,000 or 47·7 stat. miles to an inch. Das Gebiet der stärksten Erdbeben-Stösse im Jahre 1896. Von Th. Thoroddsen. Scale 1 : 750,000 or 11·9 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1901, Tafel 5. Gotha: Justus Perthes, 1901. *Presented by the Publisher.*

ASIA.

Armenia. **Lynch and Oswald.**

Map of Armenia and Adjacent Countries. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. By H. F. B. Lynch, M.A., and F. Oswald, B.SC. The material compiled by W. Shawe, F.R.G.S. London: E. Stanford, 1901. *Price 10s. 6d. Presented by the Publisher.*

The area included in this map is, approximately, from lat. 37° 10′ N. to 42° 10′ N., and from long. 32° 20′ E. to 49° 50′ E. It thus embraces portions of three countries—Russia, Turkey, and Persia—with Mount Ararat in the centre of the sheet. The material from which the map is compiled varies considerably in value and in the degree of dependence which can be placed upon it. For the Russian territory there is primarily the 5-verst government survey, which, however faulty it may be in mountainous regions, is tolerably accurate in most of the lower-lying district; but for those parts belonging to Turkey and Persia, with the exception of a few small districts that have now been fairly well mapped, nothing exist but a more or less disconnected series of route surveys, some of which are extremely rough. For the Turco-Persian frontier there are the surveys made by the Russian and English officers in 1849–1855. Quite recently a good deal of survey work has been done by English officers and others who have held official appointments in various parts of Armenia, of which perhaps that of Major F. R. Maunsell, R.A., is the latest and most reliable. All this has, as far as possible, been utilized by the authors, and Major Maunsell's work has been of special service to them, and enabled them greatly to improve their map, particularly in the neighbourhood of Lake Van.

Mr. Lynch, assisted by Mr. F. Oswald, who accompanied him on his second journey in 1898, has, with painstaking care, made use of all the most trustworthy available material furnished by others. But he has done more than this, for he has also himself travelled extensively in the country, and made route surveys and copious notes. He has also taken a great number of boiling-point and barometric observations for height, which have been carefully computed and laid down upon the map, the compilation of which has been undertaken by Mr. W. Shawe under his personal supervision; and taken as a whole the map is certainly a very creditable production, although it is to be regretted that the hillwork is so dark that in the mountainous regions it is very difficult to read many of the names.

Mr. Lynch's routes are shown in red, and a full description of these will be found in his recently published work on Armenia, which the map accompanies. Separate copies of the map can, however, be obtained at Stanford's, where it has been lithographed.

China. **Ferguson.**

Map of the Waterways near Shanghai. Scale 1 : 63,360 or 1 stat. mile to an inch. Thomas Ferguson. Shanghai: Kelly & Walsh, Ltd., 1901. 2 sheets. *Presented by the Author.*

The coast-line and the course of the lower Whangpu river have been taken from the Admiralty charts; but the remaining portions of this map are from an original

survey made by Mr. Ferguson with the aid of an instrument which he has invented, called the "hodograph." This instrument, which appears to be somewhat on the principle of a ship's patent log, and suitable for boat work, records automatically the direction and distance followed, thus, it is stated, rendering it possible to make a very rapid and tolerably accurate survey of the waterways of a country. This map includes the rivers and creeks for about 13 to 20 miles round Shanghai. As a check upon the work, most of them were passed over twice, in opposite directions, and the mean direction and distance taken and laid down. The map is in two sheets, on one of which is a list of astronomical positions, and an explanation of the symbols employed.

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, 4 miles to an inch. Sheets: 9 S.W., parts of district Hyderabad and Native State of Khairpur (Sind, Bombay Presidency), additions to 1897; 31 N.E., parts of districts Ferozepore and Indhiána, and of Patiála, Nábha, Faridkot, and Jind (Native States), Punjab, additions to 1898; 39 N.W., parts of districts Ahmednagar Poona Thána and Sátára, and of Native State Bhor (Bombay Presidency), additions to 1899; 51 N.E., parts of Native States Gwalior (C.I. Agency), Karauli, and Dholpur (Rajputana Agency), additions to 1900; 69 N.W., parts of Gwalior and Bundelkhand (C.I. Agency), and of districts Jalaun, Jhánsi, Hamirpur, and Etáwah (N.W. Provinces), additions and corrections to 1900.—Burma-China Boundary Commission, 1 inch to a mile. Seasons 1898–1900. 13 sheets.—Bengal Survey, 1 inch to a mile. Sheet 69, district Puri, Seasons 1889–90 and 1894–95. 1900.—Bombay Survey, 1 inch to a mile. Sheet 201, districts Colába, Ratnágiri, and Sátára, Seasons 1877–78 and 1879–80. 1900.—Upper Burma Survey, 1 inch to a mile. Sheets: 174, district Minbu, Season 1892–93. 1900. 260, parts of districts Mandalay, Sagaing, and Shwebo, Seasons 1890–93 and 1896–97. 1900. 312, Southern Shan States and district Meiktila, Seasons 1893–94 and 1898–99. 1900.—Central India and Rajputana Survey, 1 inch to a mile. Sheets: 210, parts of Rutlam, Sailana (C.I. Agency), and of Banswara, Kusalgarh, and Khandu (Rajputana Agency), Season 1881–82. 1899. 322, parts of Gwalior (C.I. Agency) and Kotah (Rajputana Agency), Seasons 1865–67. 1900. 364, parts of Gwalior (C.I. Agency) and of Dholpur (Rajputana Agency), Seasons 1863–65. 1900.—South-Eastern Frontier, 1 inch to 4 miles. Sheet 1 N.E., parts of districts Upper Chindwin, Katha, and Shwebo, and of Chin hills (Upper Burma), and of Manipur Native State (Assam), Seasons 1886–94 and 1897–98. 1900.—Sind Survey, 1 inch to a mile. Sheet 70, district Hyderabad, Season 1898–99. 1900.—Eastern Bengal. Sheet 12, districts Rangpur and Dinajpur, and parts of districts Jalpaiguri with Cooch-Behar, Bogra, Malda, Purnea, Rájsháhi, and Mymensingh (Bengal), Gáro Hills, and parts of districts Goálpára and Sylhet (Assam).—India to illustrate Gauges of Railways, 80 miles to an inch. 1900.—District Bhaugulpur, Lower Provinces Revenue Survey, 1 inch to a mile. 1900. 5 sheets.—District Lackhimpur, Assam, 12 miles to an inch. 1900.—District Cachar, Assam, 8 miles to an inch. 1900.—Map of the Central Provinces, 32 miles to an inch. With additions to 1900.—Central India Agency, 80 miles to an inch. 1900.—Gujarát, 16 miles to an inch. 1900.—Chart of Triangulation and Traversing Gujarát Survey, 4 miles to an inch. Degree sheet xiv., Seasons 1878–79, 1883–87, and 1890–91. 1900.—Nos. 1 and 2, Preliminary Charts of the Principal Triangulation of the Mákran Longitudinal Series, 4 miles to an inch. Seasons 1895–97. 1900. *Presented by H.M. Secretary of State for India, through the India Office.*

Russia in Asia. **Stahl.**

Deltagebiet der Flüsse Ural, Sagis und Emba. Gezeichnet von A. F. Stahl, 1899. Scale 1:1,200,000 or 19·0 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1901, Tafel 9. Gotha: Justus Perthes, 1901. *Presented by the Publisher.*

AFRICA.

Angola. **Commissão de Cartographia, Lisbon.**

Carta de Angola. Scale 1:3,000,000 or 47·4 stat. miles to an inch. Commissão de Cartographia, Lisbon, 1900. 2nd edition. *Presented by the Commissão de Cartographia.*

With the exception of some modifications of the boundaries, and a few alterations in the courses of rivers, this, the second edition of the Portuguese government map of Angola, remains very much the same as the first, which appeared in 1892. Since last year, when this edition was published, a considerable amount of fresh information has come to hand, especially with reference to the upper waters of the Zambezi and its tributaries, so that already it is far from complete in many respects.

Madagascar. **Service Géographique du Corps d'Occupation.**

Carte de Madagascar. Scale 1:1,000,000 or 15·8 stat. miles to an inch. Service Géographique du Corps d'Occupation. 6 sheets.

This map, which has been published by the French Service Géographique du Corps d'Occupation, contains a good deal of information. It is, however, not a very satisfactory production, and by far the greater number of the names are so small as to be almost illegible without a glass. It is printed in colours—hill work brown, water blue, and forests green.

AMERICA.

Amazon. **Katzer.**

Karte der Mündung des Trombetas in den Amazonas. Hauptsächlich nach den Aufnahmen der Ingenieure: Le Blanc, Robert, Haag, Paul le Cointe, Valente do Couto und nach eigenen Beobachtungen zusammengestellt von Dr. Friedrich Katzer. Scale 1:700,000 or 11·5 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1901, Tafel 4. Gotha: Justus Perthes, 1901. *Presented by the Publisher.*

Central America. **Sapper.**

Die Verbreitung der Sprachen im Südlichen Mittelamerika ums Jahr 1899. Von Dr. Carl Sapper. Scale 1:4,000,000 or 63·2 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1901, Tafel 3. Gotha: Justus Perthes, 1901. *Presented by the Publisher.*

Haiti. **Tippenhauer.**

Geologische Karte der Eruptiv-zone von Terre-Neuve (Insel Haiti). Nach eigenen Aufnahmen vom 17 Nov. bis 4 Dez. 1900 und vom 9 Jan. bis 9 Feb. 1901, gezeichnet von L. Gentil Tippenhauer, Ingenieur. Scale 1:75,000, or 1·2 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1901, Tafel 10. Gotha: Justus Perthes, 1901. *Presented by the Publisher.*

ATLANTIC OCEAN.

North Sea. **Hjort.**

Ergebnisse der ersten norwegischen "Michael Sars" Expedition, im Sommer 1900. Von Johan Hjort. Scale 1:37,000,000 or 584 stat. miles to an inch. Hydrographische Profile durch das Nordmeer. Petermanns Geographische Mitteilungen Jahrgang 1901, Taf. 7 and 8. Gotha: Justus Perthes. *Presented by the Publisher.*

CHARTS.

North Atlantic Ocean and Mediterranean Sea. **Meteorological Office, London.**

Monthly Pilot Chart of the North Atlantic Ocean and Mediterranean Sea for July, 1901. Meteorological Office, London. *Price* 6*d*. *Presented by the Meteorological Office.*

Portuguese Charts. **Commissão de Cartographia, Lisbon.**

Reconhecimento do Porto Interior da Beira, Moçambique, 1:30,000. 1899.—Reconhecimento hydrographico da Barra do Rio Tejungo, Moçambique, 1:25,000. 1898.—Plano hydrographico da Bahia do Lobito, Angola, 1:10,000. 1891.—Plano hydrographico de Landana ao Massabi, 1:40,000. 1891.—Archipelago de Cabo Verde, 1:500,000. 1900.—Ilha de Sᵗᵒ. Antão, Plano hydrographico do Porto da Ponta do Sol, Archipelago de Cabo Verde, 1:10,000. 1900.—Plano hydrographico do Porto Grande de S. Vicente, Archipelago de Cabo Verde, 1:20,000. 1900.—Reconhecimento hydrographico da Barra de Betul e Foz do Rio de Sal, Goa, 1:2,500. 1899.—Carta de Ventos e Correntes do Oceano Atlantico, Janeiro, Fevereiro, Marco. 1900. Ministerio da Marinha e Ultramar, Commissão de Cartographia, Lisbon. *Presented by the Commissão de Cartographia.*

U.S. Charts. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for July 1901, and North Atlantic Ocean for June 1901. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Andes. **Argentine Boundary Commission.**

Panorama of the Cordillera de los Andes from the Contrabandista Pass. *Presented by the Argentine Boundary Commission.*

This excellent panorama consists of enlargements from nine negatives taken by the

surveyors of the Argentine Boundary Commission. With the peak of Aconcagua to the right, and the surrounding lofty main range of the Andes stretching away in the distance, it presents a most striking appearance, as well as being very instructive geographically. It has been suitably framed, and, through the kindness of Dr. F. Moreno, has been presented by the Argentine Boundary Commission to the Map Room of the Society, upon the wall of which it now hangs.

"Discovery." **Wilson-Barker.**

Five photographs of the launching of the *Discovery*, Dundee, March 21, 1901, by Captain D. Wilson-Barker, F.R.S.E. *Presented by Captain D. Wilson-Barker.*

Egyptian Sudan. **Gwynn.**

Fifty-one photographs of natives and scenery of the Blue and White Niles, and the Sobat River. By Major C. W. Gwynn, R.E., D.S.O. 1900. *Presented by Major Gwynn.*

This is an interesting set of photographs, and are specially important, inasmuch as some parts of the region through which Major Gwynn travelled are at present very little known.

(1) Womber Yembo, steward to Dijay Goti, Lega Galla; (2) Lega Galla, Jebel Sonka; (3-7) Lega Galla; (8) Cotton market, Gidami; (9) Native parasol, Gidami; (10-16) Galla types, Gidami; (17) Galla types showing women's hair; (18) Galla with Berta slave; (19, 20) Galla types; (21) Gidami market; (22) K. Masarkum, Fazokli; (23) K. Garre, showing cattle, Galla country; (24) Abyssinian soldiers; (25) Barun village of Abajala, K. Garre; (26) Baruns at a funeral, Abajala; (27) Dinka boys, Uryong, on the Sobat 40 miles above its mouth; (28) Result of an hour's fishing with hand-lines, Nasser; (29) Interior of Nasser fort; (30) Nuers at Shillup, 20 miles below Nasser; (31) Nuer Tukl, Shillup; (32) Nuer rain-maker; (33) Old Nuer near Nasser, wooden pillow being returned to him; (34) Old Nuer; (35) Hippo on the river Baro (Natives are Nuers); (36) Hippo on the River Baro, Nuer aborigines and Sudanese soldiers; (37) Remains of French garden, Fashoda; (38) Blue Nile between Wad Midani and Sennar; (39) Blue Nile between Karkoj and Roseires; (40) Blue Nile emerging from Abyssinian hills 20 miles east of Famaka; (41) Blue Nile 20 miles East of Fazokli; (42) Blue Nile 20 miles east of Famaka, looking east; (43) Blue Nile below Sennar; (44) K. Garre in the Abyssinian hills; (45) Fashoda, old Egyptian lines and new French fort; (46) Fashoda: a Dinka on opposite bank, showing curious method of doing hair; (47) Cultivated country, Lega Galla; (48) J. Kehli, type of hills outlying the edge of Abyssinian plateau; (49) Lega Galla, Gidami market; (50) Gomasha plateau, looking north to the larger of the two Gule peaks; (51) Nasser, Nuer sheikh; (52) Bamboo-covered country, Amam; (53) Sheep from Fazokli; (54) Berta guides from Kirin; (55) K. Yabus, showing native bridge; (56) Gomasha plateau; (57) The West Yabus near Gubu Gola, Amam country; (58) Bamboo-covered country, Amam, south of Kirin; (59) Sheikh of Kirin; (60) Type of donkey-saddle made in the arsenal, Cairo: Major Austin's pattern; (61) Mek of Kehli; (62) Berta guides, Fazokli; (63) Mek of Fazokli.

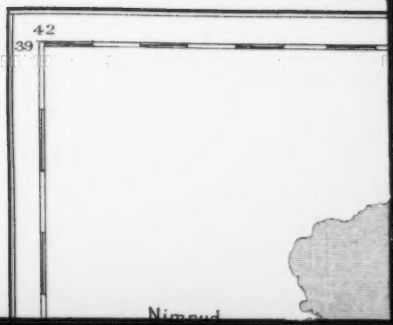
North-East Africa. **Bright.**

Twenty photographs of Natives and Scenery between Southern Abyssinia and the Nile, by Major R. G. T. Bright, 1899-1900. *Presented by Major Bright.*

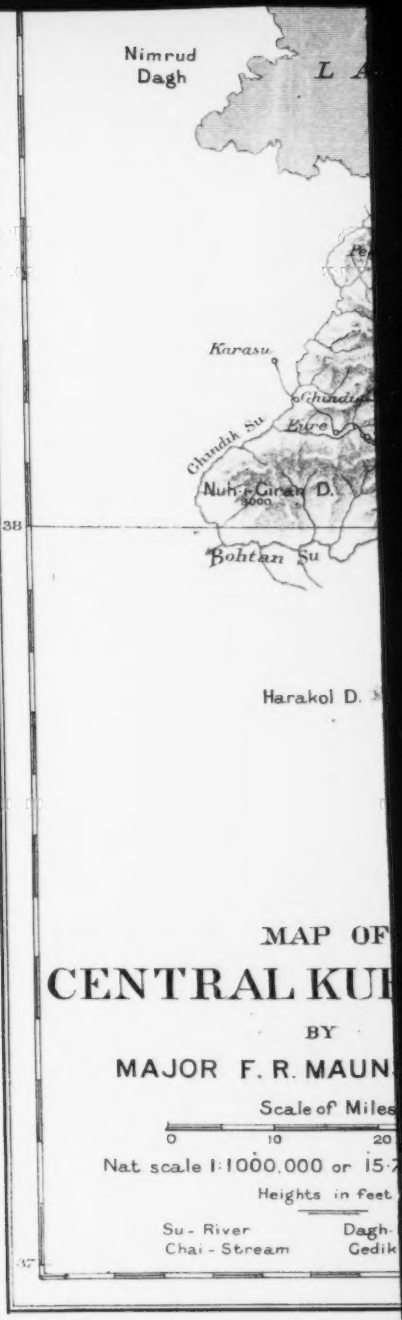
The following are the titles of the photographs taken by Major R. G. T. Bright during his recent expedition. They are all interesting, and many of them are remarkably well taken:—

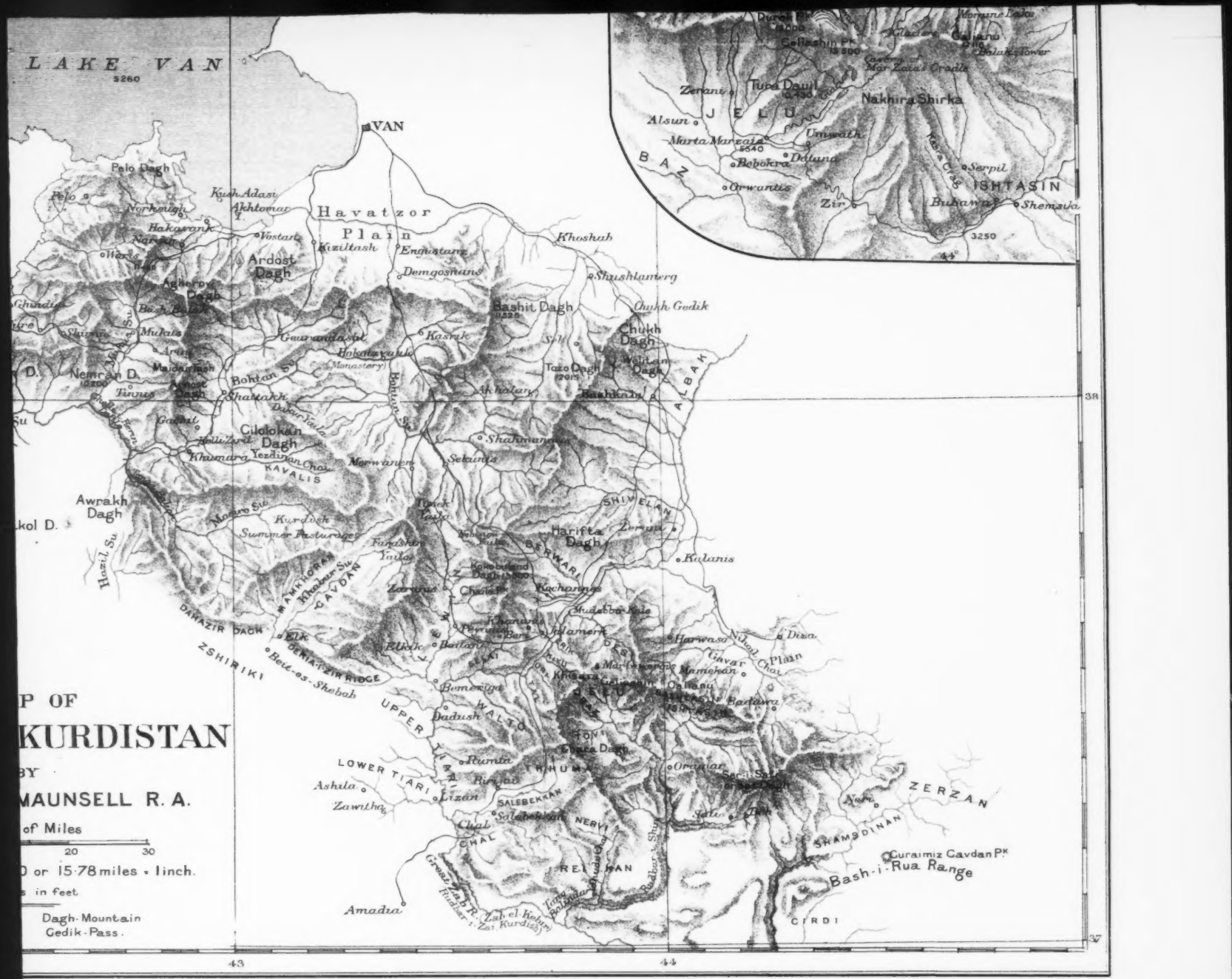
(1) Abyssinians of Buré; (2) View on Abyssinian plateau; (3) Baro river, showing cultivation in Annuak country; (4) River Baro, full of water; (5) Baro river, water very low; (6) View of the Galla country; (7) Annuak homestead; (8) Annuak maidens; (9) Interviewing the Annuaks; (10) Preparing to cross the river Piebor; (11) Road from Goré to Buré; (12) Dinkas; (13) Nuer warriors; (14, 15) Nuer village on the Sobat; (16) Nuer sheikh with friends; (17) Nuer sheikh seated on canteen; (18) Sheikh Vowi's son and Nuers; (19) Escort of 11th Soudanese Battalion; (20) Donkey ferrying food.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.


42
39
Nimrud

43
44
45
39
Sipan Dagh
JELU RANGE
Scale of Miles
1 0 1 2 3 4 5
1: 250 000 or 1 inch = 4 miles
Suwa
5820
Khisara
Pk.
10422
Orisha
7020
37° 30'
Glaciers


Nimrud Dagh
Karasu
Chundik Su
Nuh-e-Ginan D.
5000
38
Bohtan Su
Harakol D.
MAP OF
CENTRAL KUR
BY
MAJOR F. R. MAUN
Scale of Miles
0
10
20
Nat scale 1:1000,000 or 15·7
Heights in feet
Su - River
Chai - Stream
Dagh-
Gedik
37



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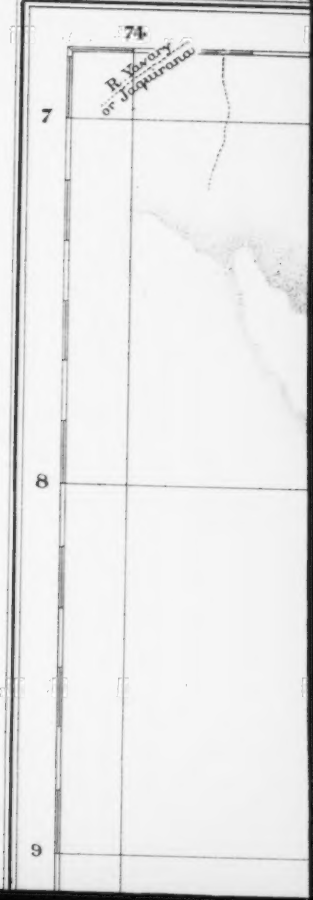
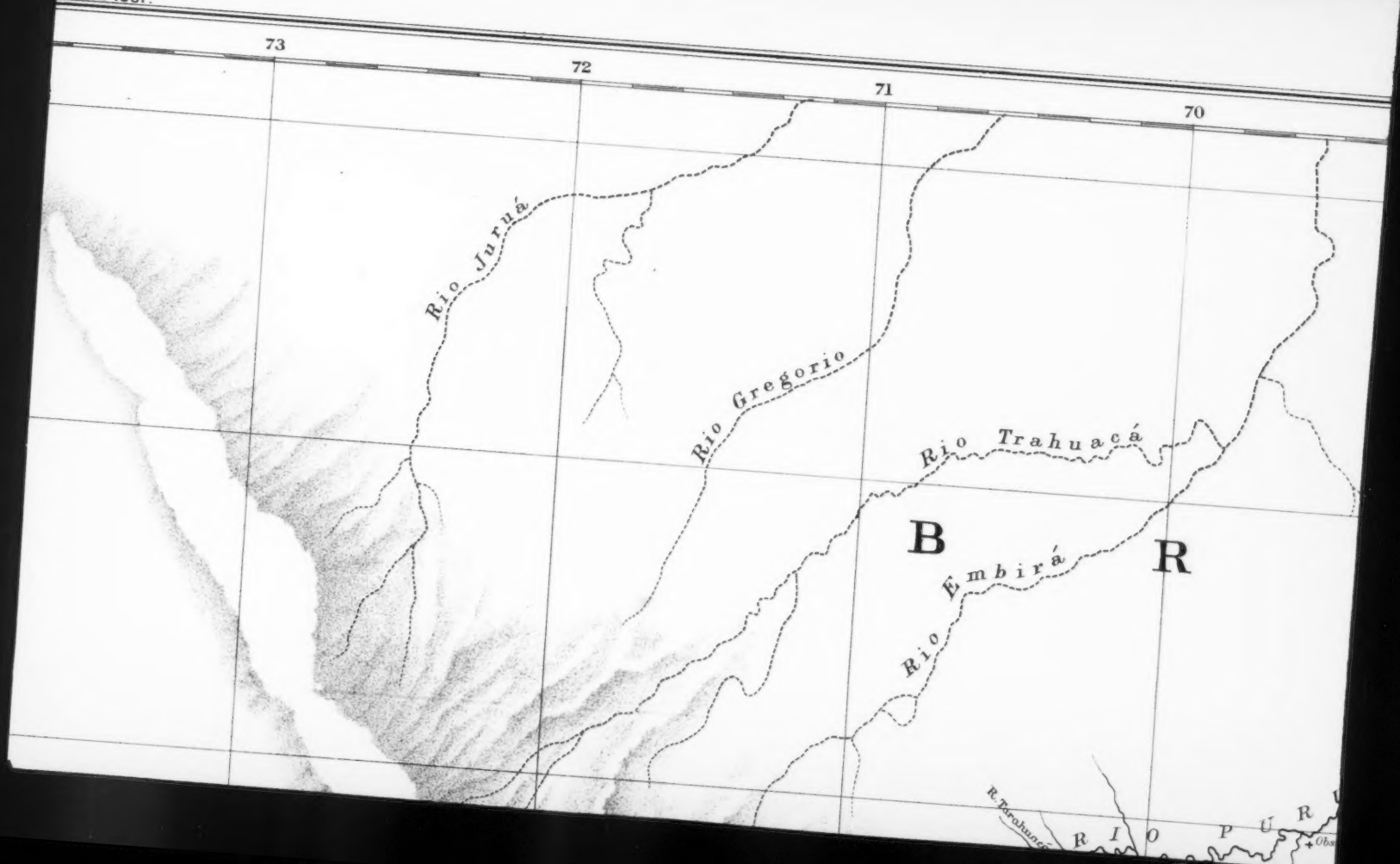
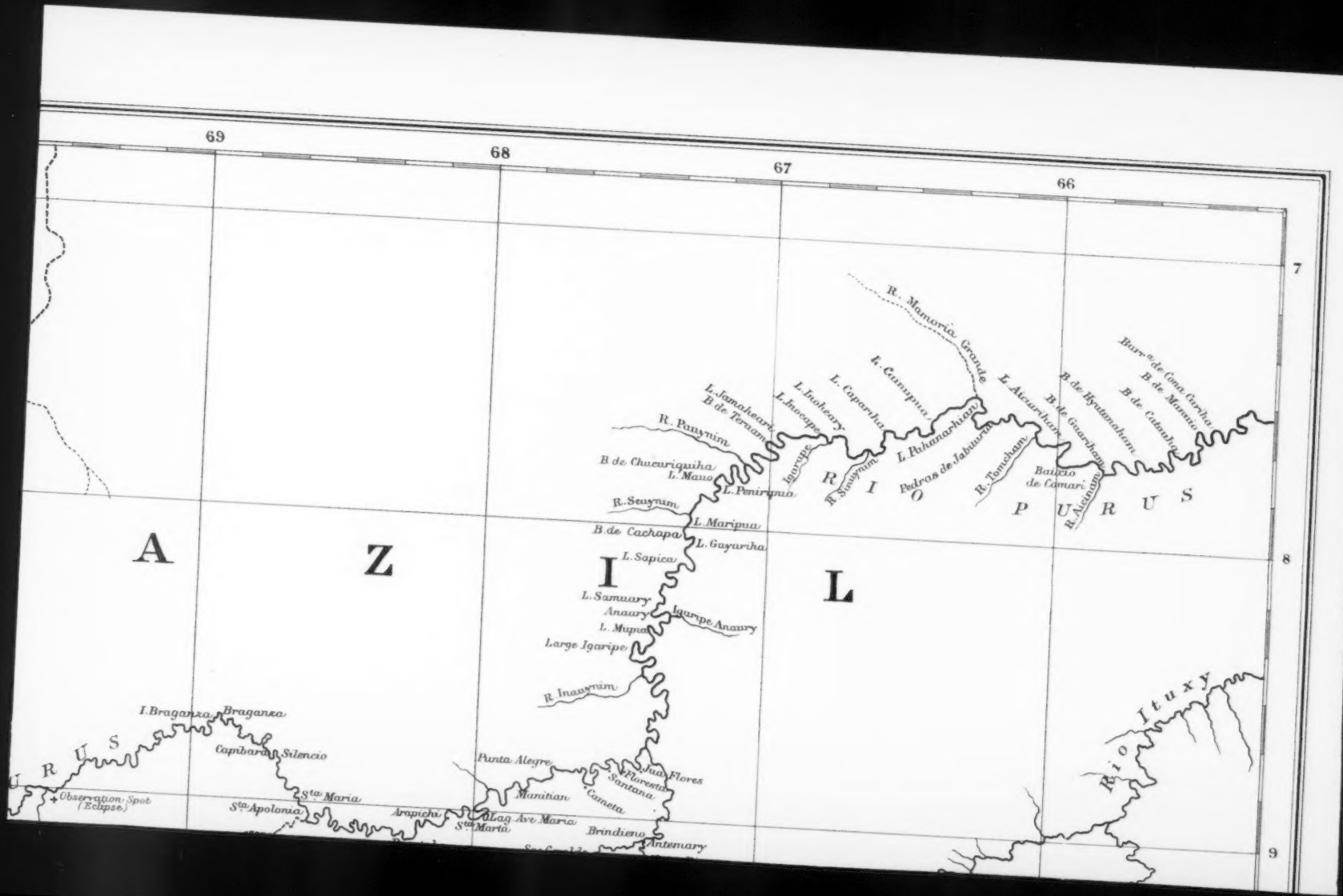
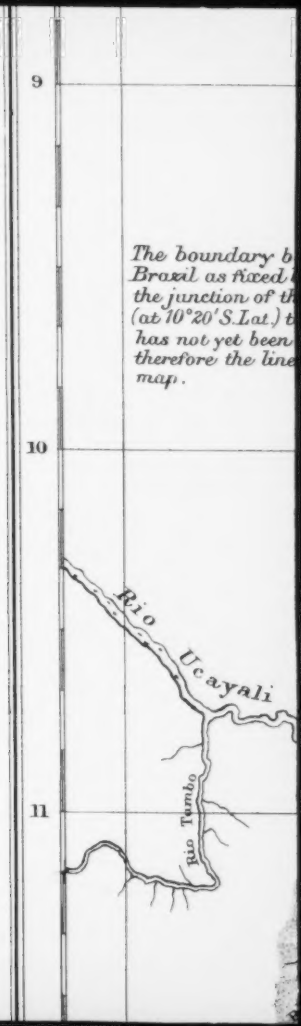
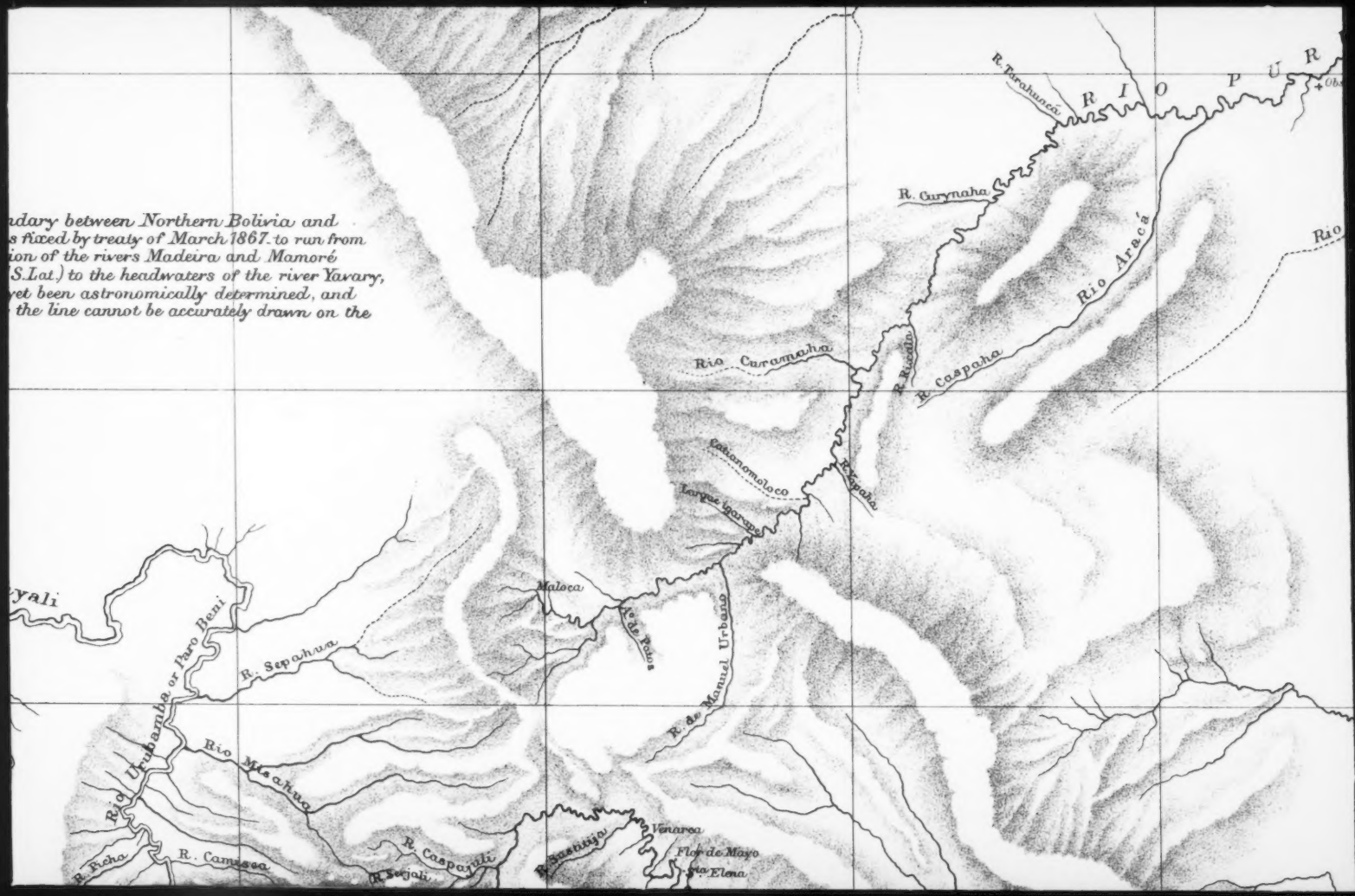
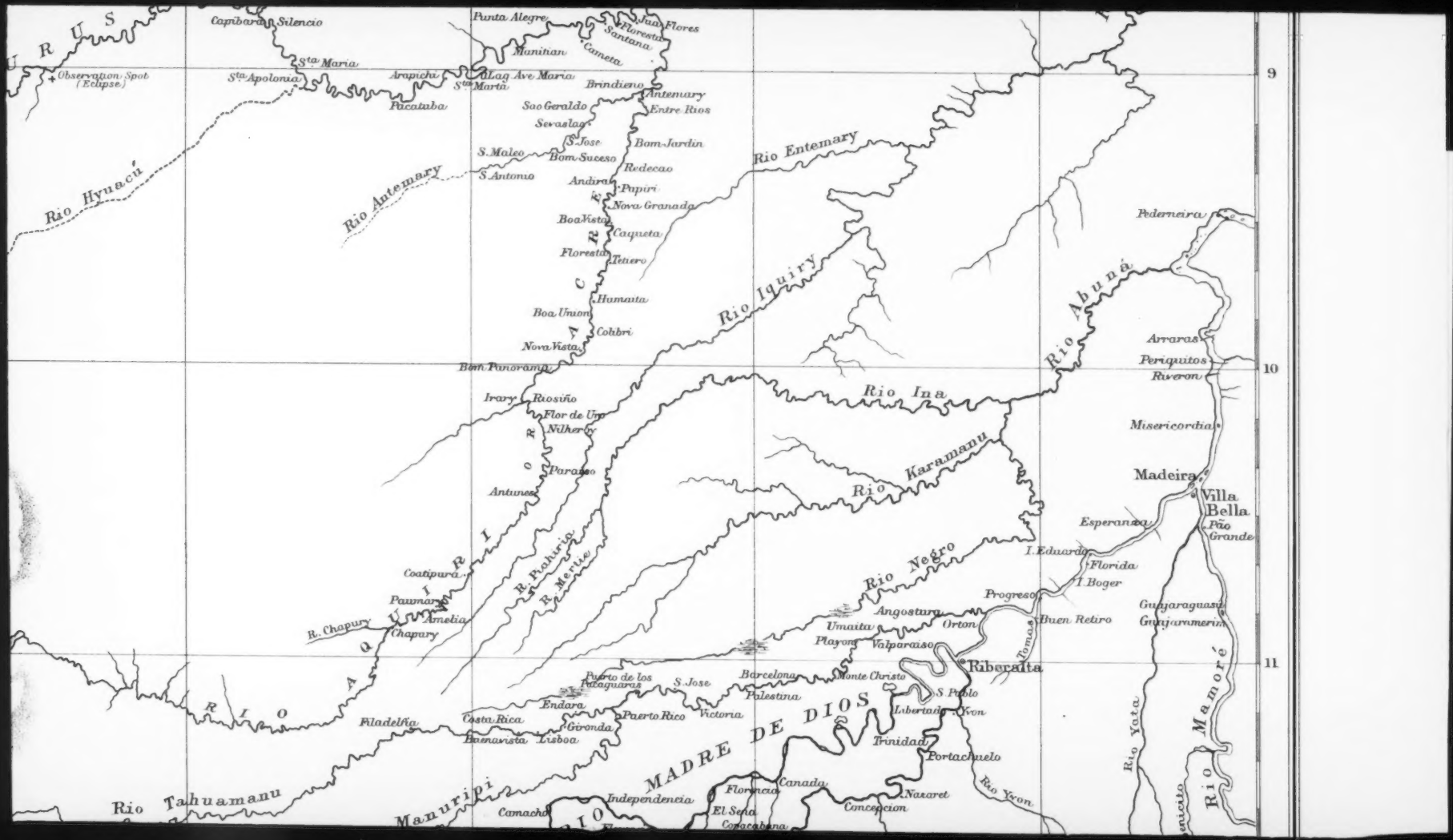

74
R. Yavary or Jaquirana
7
8
9

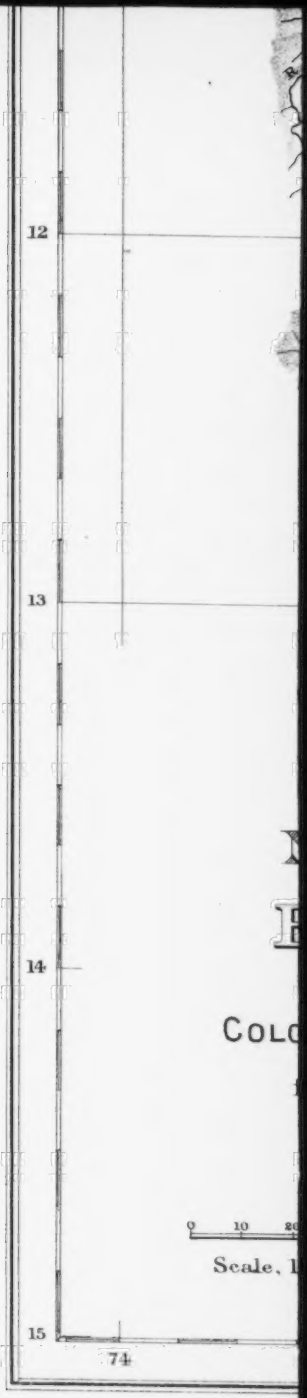

73
72
71
70
Rio Juruá
Rio Gregorio
Rio Trahuacá
Rio Embirá
B
R
R. Tarahuacá
R I O P Ú R U
Obs

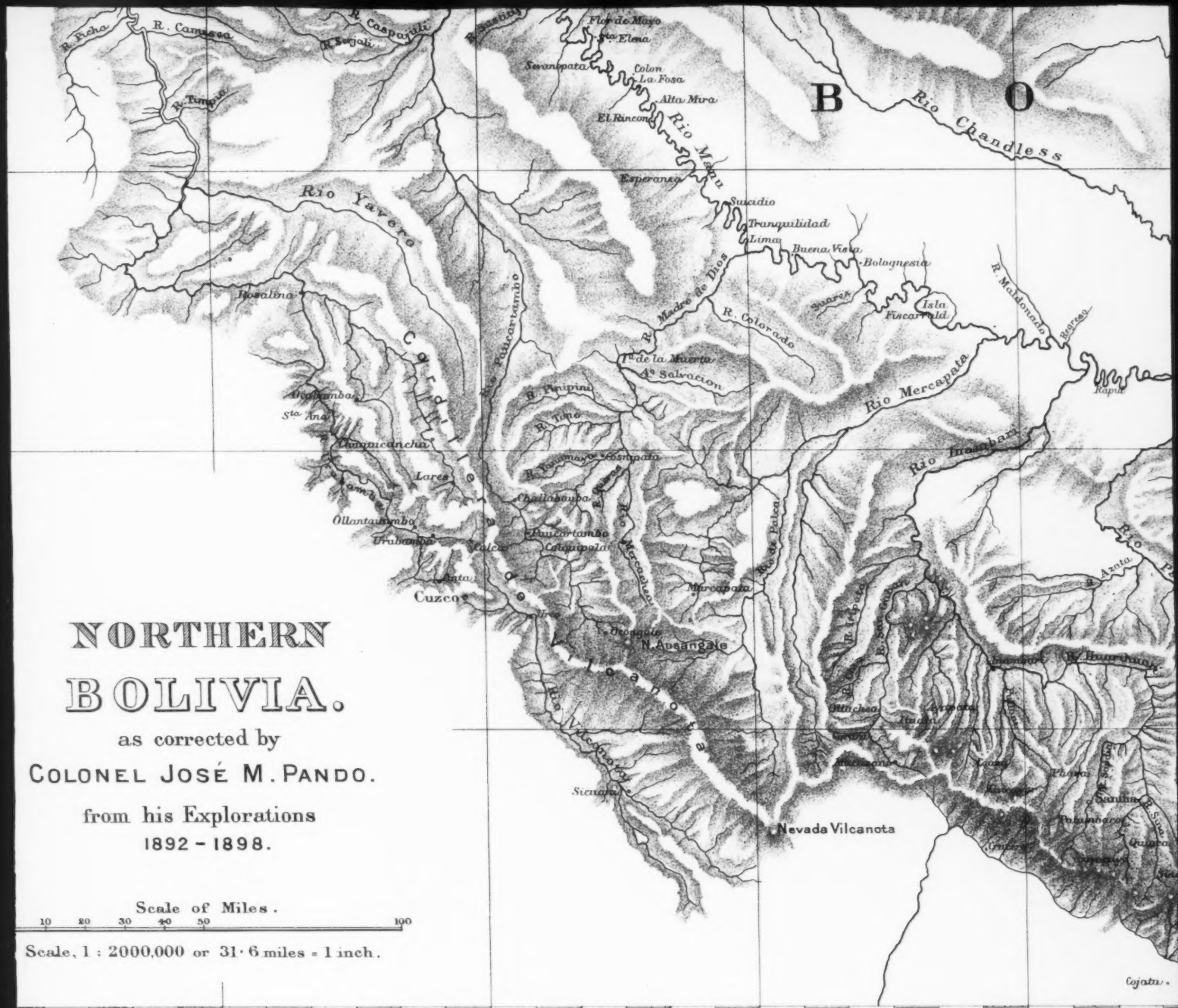

69
68
67
66
7
8
9
A
Z
I
L
R. Mamoria Grande
L. Curupua
L. Acuarihan
L. Jamaheark
B. de Teraam
L. Inoheary
L. Inocopé
L. Caparihu
L. Pahanarhiari
B. de Hyutamaham
B. de Guarihan
Barra de Cima Curiha
B. de Manaos
B. de Catauhy
R. Pauxyuim
B. de Chucariquiha
L. Mauo
Igarape
R. Siauyuim
Pedras de Jabiuna
R. Tomchan
Barreiro de Camari
R. Aleinaus
R. Seuyuim
L. Penirauia
R I O P U R U S
B. de Cachapa
L. Maripua
L. Gayuriha
L. Sapica
L. Samuary
Anaury
Igaripe Anaury
L. Mupia
Large Igaripe
R. Inauyuim
Rio Ituxy
I. Braganza
Braganza
Capibara
Silencio
Punta Alegre
Flores
Floresta
Santana
Manitian
Cameta
Observation Spot (Eclipse)
Sta Maria
Sta Apolonia
Arapicha
Lag Ave Maria
Sta Marta
Brandiero
Antenary


9
10
11
The boundary b
Brazil as fixed
the junction of th
(at 10°20' S. Lat.) t
has not yet been
therefore the line
map.
Rio Ucayali
Rio Tambo


ndary between Northern Bolivia and
s fixed by treaty of March 1867. to run from
ion of the rivers Madeira and Mamoré
S.Lat.) to the headwaters of the river Yavary,
yet been astronomically determined, and
the line cannot be accurately drawn on the
R. Tarahuacá
R I O P U R
R. Curynaha
Rio Caramanha
R. Rixito
R. Caspaha
Rio Aracá
Rio
Catanomoloco
Largue Igarape
R. Espaha
yali
Maloca
R. de Patos
R. de Manuel Urbano
R. Sepahua
R. d. Urubamba or Paro Reni
Rio Mishahua
R. Ucha
R. Camisea
R. Kejali
R. Caspajali
R. Santiaja
Venarea
Flor de Mayo
Sta Elena


Capibara
Silencio
Punta Alegre
Jua Flores
Floresta
Santana
Caneta
Manihan
Sta Maria
Observation Spot (Eclipse)
Sta Apolonia
Arapicha
Lag Ave Maria
Sta Marta
Brindiero
Antenary
Pacataba
Sao Geraldo
Entre Rios
Sevastag
S. Jose
Bom Jardin
S. Malco
Bom Sucesso
Redecao
S. Antonio
Andira
Papiri
Nova Granada
Boa Vista
Caqueta
Floresta
Tenero
Humaita
Boa Union
Colibri
Nova Vista
Bom Panorama
Irary
Riosiño
Flor de Uro
Nilheroy
Paraizo
Antunes
Coatipura
Paumary
Amelia
Chapury
R. Chapury
R. Pahuria
R. Merue
Rio Hyuacú
Rio Antemary
Rio Iquiry
Rio Entemary
Rio Ina
Rio Karamanu
Rio Negro
Rio Abuná
Pederneira
Arraras
Periquitos
Riveron
Misericordia
Madeira
Villa Bella
Pão Grande
Esperanza
I. Eduardo
Florida
I. Boger
Progreso
Angostura
Huen Retiro
Guajaraguasu
Guajaramerim
Umaita
Orton
Playon
Valparaiso
Riberalta
Tomas
Barcelona
Monte Christo
Palestina
S. Pablo
Libertade
Yvon
Trinidad
Portachuelo
Rio Yata
Rio Mamoré
Rio Yvon
Florencia
Canada
Navaret
Concepcion
Independencia
El Sena
Camacho
Rio Tahuamanu
Manuripi
Filadelfia
Costa Rica
Gironda
Baenavista
Lisboa
Endara
Puerto Rico
Victoria
Puerto de los Patagnaraz
S. Jose
RIO ACRE
RIO AQUIRI
RIO MADRE DE DIOS
9
10
11


12
13
14
15
Colo
9 10
Scale, 1
74



NORTHERN BOLIVIA.

as corrected by

COLONEL JOSÉ M. PANDO.

from his Explorations

1892 - 1898.

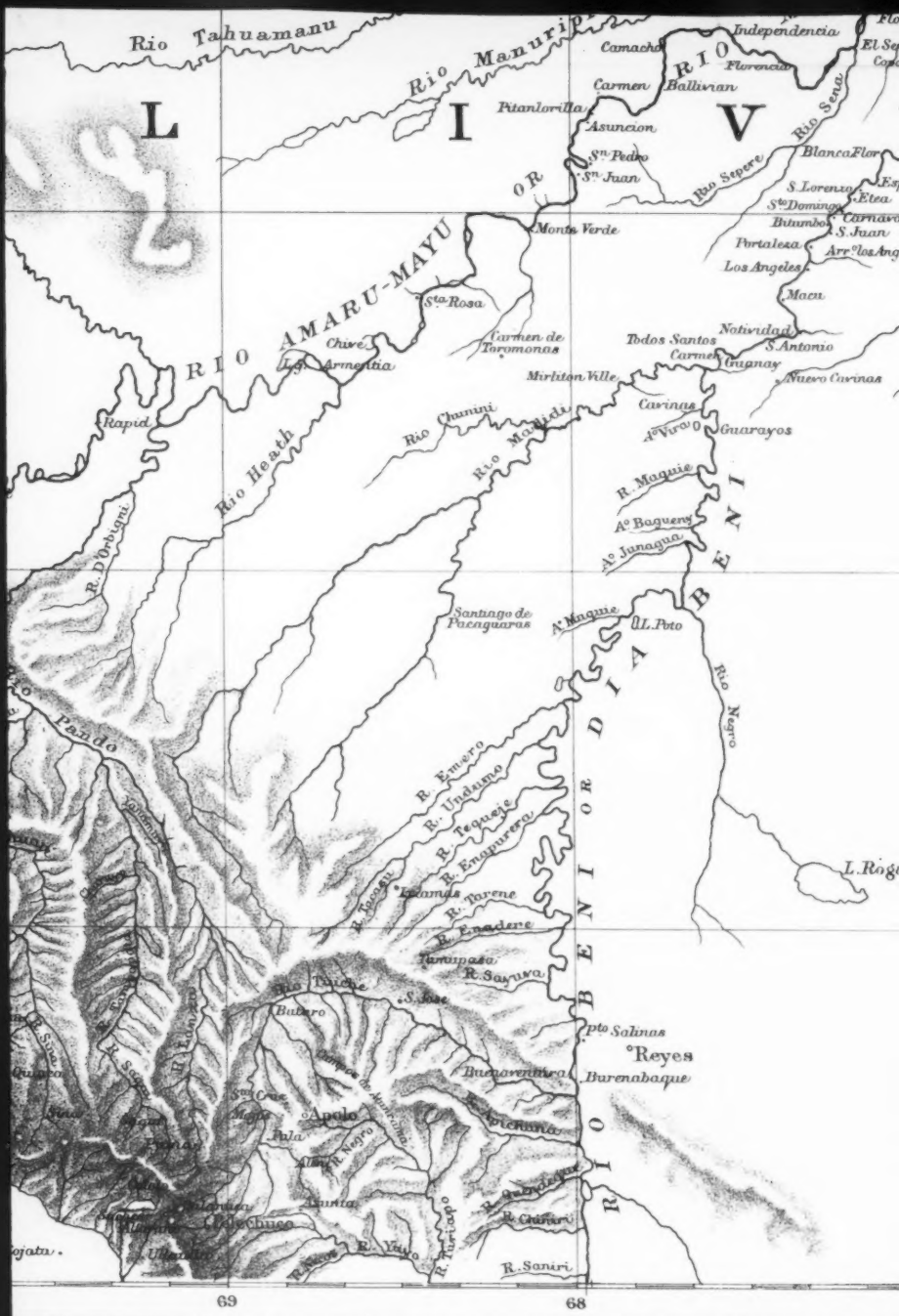
Scale of Miles.

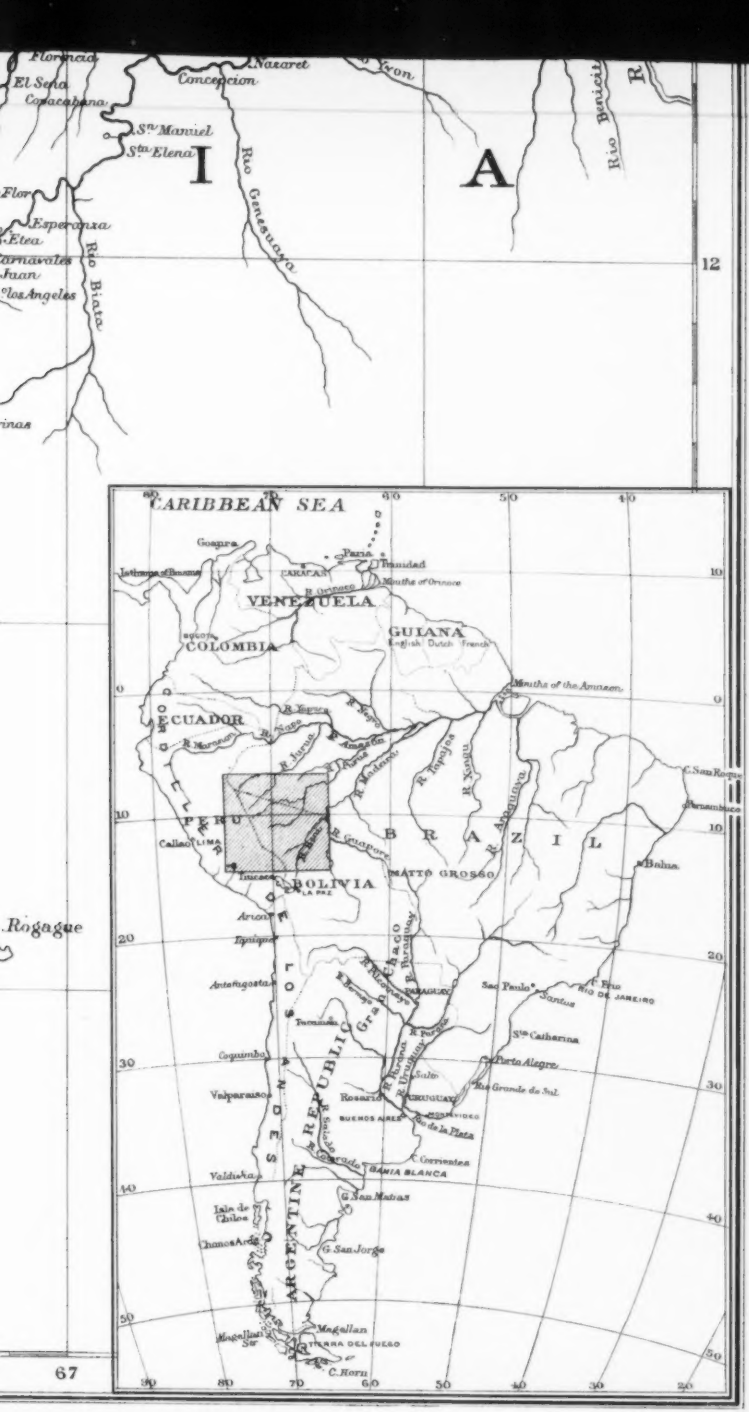
10 20 30 40 50 100

Scale, 1 : 2000,000 or 31·6 miles = 1 inch.

73 72 71 West of Greenwich 70

Published by the Royal Geo


Rio Tahuamanu
Rio Manuripi
Camacho
Independencia
Florencia
Carmen
Ballivian
Pitanlorilla
Asuncion
Sn. Pedro
Sn. Juan
Rio Sena
Rio Sepere
Blanca Flor
S. Lorenzo
Sto. Domingo
Bitumbo
Portaleza
Arr.o los Angeles
Los Angeles
Macu
Monte Verde
Sta. Rosa
Chive
Armentia
Carmen de Taromonas
Todos Santos
Notividad
Carmen
S. Antonio
Guanay
Nuevo Covinas
Mirliton Ville
Covinas
Guarayos
Rapid
Rio Heath
Rio Chunini
Rio Madidi
R. Maguie
A.o Baguery
A.o Junagua
R. Dorbigni
Santiago de Pacnaguaras
A. Maguie
L. Poto
Rio Negro
L. Rogoagua
R. Emero
R. Undumo
R. Tequeje
R. Enapurera
R. Torene
R. Enadere
Tamupaza
R. Sarura
Rio Tuiche
S. Jose
Buturo
pto Salinas
Reyes
Buenaventura
Burenabaque
Apolo
Apichuma
Mapiri
Tuichi
Asunta
Chulumani
Ulla Ulla
R. Yuyo
R. Mariapo
R. Saniri
R. Cravari
R. Quiquibey
R. Beni
69
68


CARIBBEAN SEA
Guapra
Paria
Trinidad
Isthmus of Panama
CARACAS
Mouths of Orinoco
R. Orinoco
VENEZUELA
GUIANA
English Dutch French
COLOMBIA
Mouths of the Amazon
ECUADOR
R. Napo
R. Negro
R. Madeira
R. Tapajos
R. Xingu
R. Araguaya
C. San Roque
Pernambuco
PERU
Callao
LIMA
R. Ucayale
R. Guapore
B R A Z I L
Bahia
MATTO GROSSO
BOLIVIA
LA PAZ
Arica
Tacna
R. Pilcomayo
R. Bermejo
Antofagasta
PARAGUAY
Sao Paulo
Santos
RIO DE JANEIRO
Tucuman
Sta Catharina
Coquimbo
Porto Alegre
Valparaiso
Rosario
URUGUAY
Rio Grande do Sul
BUENOS AIRES
MONTEVIDEO
Rio de la Plata
C. Corrientes
Valdivia
BAHIA BLANCA
G. San Matias
Isla de Chiloe
Chanos Arch.
G. San Jorge
ARGENTINE REPUBLIC
Magellan Str.
Magellan
TIERRA DEL FUEGO
C. Horn
80
70
60
50
40
30
20
10
0